WATERSHED MANAGEMENT PLAN FOR:

PUTERBAUGH CREEK – HEATON LAKE WATERSHED

ELKHART COUNTY, INDIANA

JANUARY, 2006

Prepared For:

ELKHART COUNTY COMMISSIONERS
SECTION 205(j) WATERSHED PLANNING GRANT

Prepared By:

LAWSON-FISHER ASSOCIATES P.C.
525 West Washington Avenue
South Bend, Indiana 46601

JOHN E. FISHER
REGISTERED
No. 14173
STATE OF INDIANA
PROFESSIONAL ENGINEER

John E. Fisher, P.E.
Chairman

January 31, 2006
Date

PIPER C. TITTLE
REGISTERED
No. 19700091
STATE OF INDIANA
PROFESSIONAL ENGINEER

Piper C. Tittle, P.E.
Senior Civil Engineer

January 31, 2006
Date

CHRISTOPHER J. JETER
REGISTERED
No. 10100878
STATE OF INDIANA
PROFESSIONAL ENGINEER

Christopher J. Jeter, P.E.
Civil Engineer

January 31, 2006
Date

PUTERBAUGH CREEK – HEATON LAKE WATERSHED MANAGEMENT PLAN

ELKHART COUNTY COMMISSIONERS SECTION 205(j) WATERSHED PLANNING GRANT

TABLE OF CONTENTS

PUTERBAUGH CREEK – HEATON LAKE WATERSHED MANAGEMENT PLAN

ELKHART COUNTY COMMISSIONERS SECTION 205(j) WATERSHED PLANNING GRANT

TABLE OF CONTENTS (CONTINUED)

i. Acronyms and Abbreviations

BMP – Best Management Practice
BOD – Biological Oxygen Demand
CL_2 - Chlorides
CMP – Corrugated Metal Pipe
CR – County Road
CRP – Conservation Reserve Program
DO – Dissolved Oxygen
E. Coli – Escherchia coli
ECC – Elkhart County Commissioners
ECHD – Elkhart County Health Department
ECPD – Elkhart County Planning Department
EQIP – Environmental Quality Incentive Program
FEMA – Federal Emeregency Management Agency
GIS – Geographic Information System
HUC – Hydrologic Unit Code
IAC – Indiana Administrative Code
IBI – Index of Biotic Integrity
IDEM – Indiana Department of Environmental Management
IDNR – Indiana Department of Natural Resources
LARE – Lake and River Enhancement Program
LRR – Lateral Recession Rate
MACOG – Michiana Area Council of Governments
MBAS – Surfactants
MDEQ – Michigan Department of Environmental Quality
mg/L – milligrams per liter
mls – milliliters
MPN – most probable number
NH_3-N – Ammonia Nitrogen
NO_4-N – Nitrate Nitrogen
NPDES – National Pollutant Discharge Elimination System
NRCS – Natural Resource Conservation Service
ppm – parts per million
PTI – Mitchell and Stapp Pollution Tolerance Index
PVC - Polyvinylchloride
QAPP – Quality Assurance Project Plan
SRF – State Revolving Fund
SWCD – Soil and Water Conservation District
TDS – Total Dissolved Solids
TKN – Total Kjeldahl Nitrogen
TSS – Total Suspended Solids
USDA – United States Department of Agriculture
USGS – United States Geological Survey
WISE – Watershed Initiative for a Safer Environment

ii. Planholders

Elkhart County Commissioners

Elkhart County Administrator

Elkhart County Health Department

Elkhart County Department of Planning and Zoning

Elkhart County Surveyor's Office

Elkhart County Soil and Water Conservation District Office

Elkhart County Purdue Cooperative Extension Office

Indiana Department of Environmental Quality – Office of Water Quality Management

City of Elkhart Department of Public Works

St. Joseph River Basin Commission

Elkhart County Public Library – Osolo Branch

Heaton Lake Conservation Club

I. Introduction

A. General

The purpose of this document is to provide guidance and information to Elkhart County and other entities interested in the water quality of the Puterbaugh Creek – Heaton Lake Watershed. The planning process for the Watershed Management Plan was initiated by the Elkhart County Commissioners as part of an IDEM Section 205(j) Grant Project. The goal of the grant project was to address water quality issues related to point and non-point source pollution in the watershed. The Puterbaugh Creek Watershed was selected as the study area due in large part to the expansive growth and development within its boundary. The vision and mission statements developed for this planning endeavor are stated below:

Vision: *Improved water quality within the Puterbaugh Creek – Heaton Lake Watershed to support aquatic resources, protect public health and provide an enhanced aesthetic environment.*

Mission: *Provide the framework by which to reduce contaminants to Puterbaugh Creek and to work closely with other watershed groups whose focus is on improving the water quality within the Elkhart River and St. Joseph River Basins.*

B. Watershed Introduction

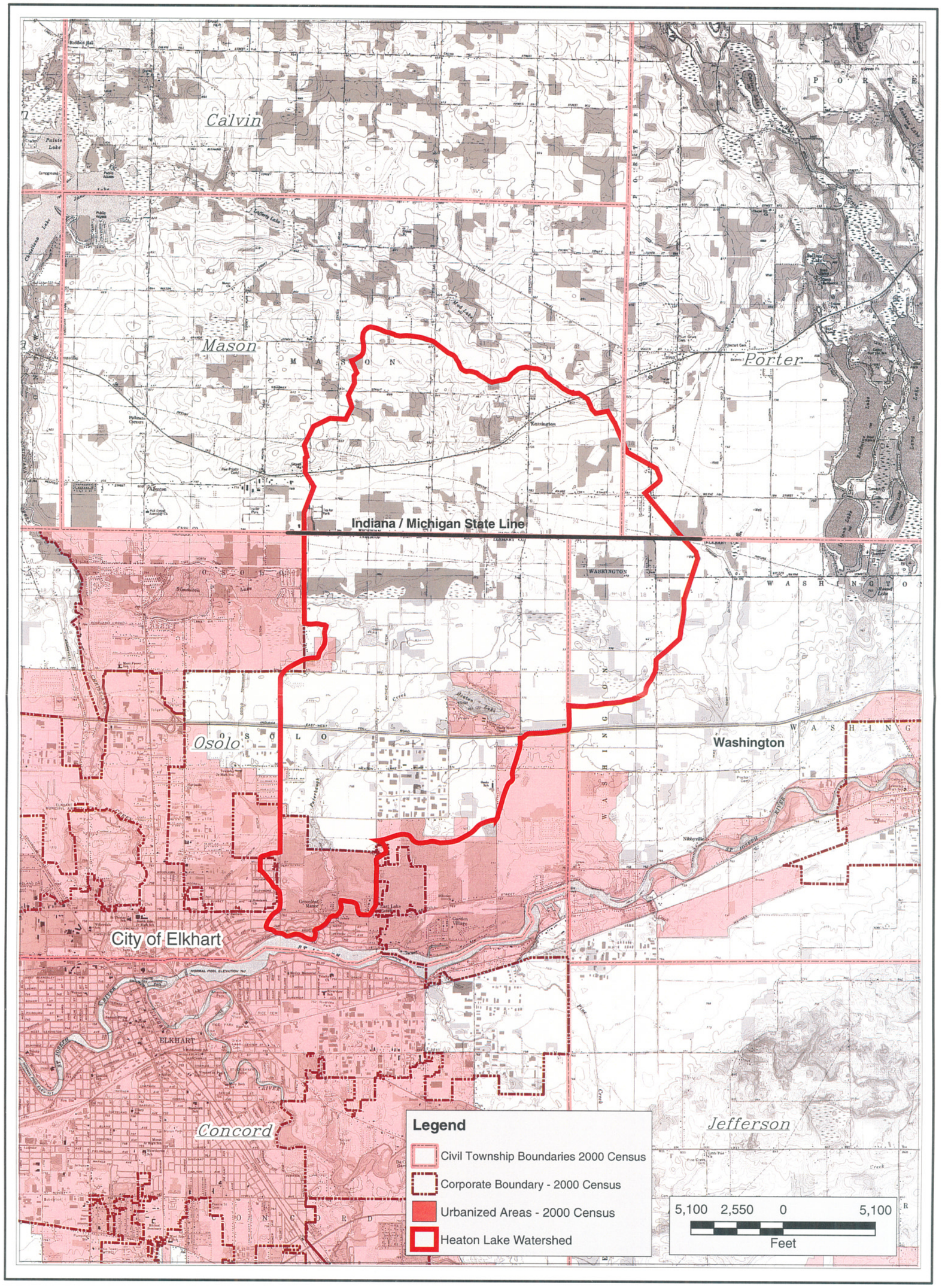
Most of the Puterbaugh Creek – Heaton Lake Watershed is located within the unincorporated area of Elkhart County. The northern portion of the watershed is within the State of Michigan, and the southern portion of the watershed is within the City of Elkhart limits. The watershed area is 10,909 acres and is composed of a variety of land uses. The watershed is shown in Figure 1. Portions of the watershed around Heaton Lake and at the southern tip of the watershed are classified as urban areas (population density of 500 per square mile or greater) and are subject to the NPDES Phase II Stormwater Regulations, as administered by IDEM through Indiana Rule 13. Puterbaugh Creek is a tributary to the St. Joseph River. The St. Joseph River discharges into Lake Michigan. The southern portion of the watershed is primarily residential and industrial. The remainder of the watershed is primarily agricultural and undeveloped land, with some residential clusters throughout.

C. Concerns

A number of concerns have been raised regarding water quality within the Puterbaugh Creek – Heaton Lake Watershed throughout the watershed management planning process, as well as prior to the initiation of this watershed management plan. The following provides a summary of the concerns that have been raised by various entities:

- The effect of increased development on water quality with respect to use of on-site wastewater disposal systems. (Elkhart County Health Department, Elkhart County Commissioners, and Local Residents).

Map Document: (Z:\200406_00\Finals\Figure-1.mxd)
2/3/2005 -- 10:55:14 AM



January 2006	200406	Figure 1	LAWSON-FISHER ASSOCIATES P.C. CONSULTING ENGINEERS 525 W. WASHINGTON AVENUE SOUTH BEND, INDIANA 46601 PH. (574) 234-3167	N W E S			Elkhart County 205(j) Grant Puterbaugh Creek - Heaton Lake Watershed Management Plan Puterbaugh Creek - Heaton Lake Watershed

- The effect of agricultural practices on the water quality of Puterbaugh Creek, including the use of fertilizers and pesticides and surface runoff. (Soil and Water Conservation District).

- The effect of increased development on water quality related to construction activities and increased impervious areas. (Elkhart County Health Department, Elkhart County Surveyor, and Local Residents).

- Direct discharge of septic tank effluent to creeks and ditches. (Elkhart County Health Department and Local Residents).

- Failing on-site wastewater disposal systems. (Elkhart County Health Department and Local Residents).

- The effect of increased development on the volume of stormwater runoff, possibly contributing to increased peak flows and erosion potential. (Elkhart County Government and Local Residents).

- The effect of increased industrial/manufacturing activities in the south-central and eastern portion of the watershed on water quality. (Local Residents).

D. Partnerships

Throughout the watershed planning process, a number of partnerships were developed. A list of the various stakeholders follows:

- Elkhart County Commissioners (ECC)
- Elkhart County Health Department (ECHD)
- Elkhart County Department of Planning and Zoning
- Elkhart County Surveyor's Office
- Elkhart County Soil and Water Conservation District (ECSWCD)
- Elkhart County Natural Resource Conservation Service
- Heaton Lake Conservation Club

E. Public Involvement

The public has been involved throughout the watershed planning process. This involvement was achieved through public meetings, as well as the quarterly planning meetings of the Joint Steering Committee.

An initial public meeting for the Puterbaugh Creek – Heaton Lake Watershed Management Plan was held at the Eastwood School on March 11, 2004. The meeting included an overview of water quality issues (point and non-point source pollution, the watershed planning process, and on-site waste disposal systems). Additionally, a Joint Steering Committee was established with some of the attendees of the meeting. The Joint Steering Committee was primarily composed of local residents and County employees.

Six (6) planning meetings were held with the Joint Steering Committee. These meetings were held on:

June 16, 2004
September 29, 2004
December 15, 2004
March 24, 2005
June 30, 2005
October 6, 2005

A final Public/Stakeholder Meeting to present the Watershed Management Plan was held on November 16, 2005 at Eastwood School.

Items discussed at the Joint Steering Committee Meetings and Public Meetings included water quality results, community concerns, and watershed planning progress. Public meeting notices, agendas, sign-in sheets, and handouts are included in Appendix A.

The Watershed Management Plan was also presented at the October 31, 2005 Elkhart County Commissioner's Meeting.

II. Background

A. Elkhart County

Most of Elkhart County is located within the St. Joseph River-Lake Michigan Watershed (H.U.C. 04050001). This basin is shown in Figure 2. Puterbaugh Creek is a tributary to the St. Joseph River. The St. Joseph River is listed on Indiana's 303(d) list for *E. Coli*. In addition, nearly 100% of Elkhart County is included in the priority area delineated on the Unified Watershed Assessment Map for Indiana. The land use in unincorporated Elkhart County is primarily agricultural with a small percentage of single-family residential, commercial and industrial areas.

The Puterbaugh Creek – Heaton Lake Watershed has been identified as an area of concern by local government and the residents within the watershed. In particular, those residents around Heaton Lake in the central portion of the watershed have been concerned due to the widespread use of on-site wastewater disposal systems. The residents have seen a decrease in the water quality of the lake through the years and this has become a cause for concern. In addition to the concerns over the use of septic systems, the watershed has seen an increase in development, thus resulting in an increase of stormwater runoff to the ditches and streams within the watershed. Therefore, Elkhart County decided to pursue a grant from the United States Environmental Protection Agency (USEPA) to help identify the potential sources of pollution within the watershed and to develop Best Management Practices (BMPs) to enhance the water quality in the watershed.

Elkhart County 205(j) Grant
Puterbaugh Creek - Heaton Lake
Watershed Management Plan

St. Joseph River Basin

Van Buren, Michigan

Kalamazoo, Michigan

Calhoun, Michigan

Lake Michigan

Berrien, Michigan

Cass, Michigan

St. Joseph, Michigan

Branch, Michigan

Hillsdale, Michigan

Heaton Lake - Puterbaugh Creek Watershed

State Line

St. Joseph, Indiana

Elkhart, Indiana

Lagrange, Indiana

Steuben, Indiana

Noble, Indiana

De Kalb, Indiana

Kosciusko, Indiana

50,000 25,000 0 50,000
Feet

N
W E
S

LAWSON-FISHER
ASSOCIATES P.C.
CONSULTING ENGINEERS
525 W. WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601
PH. (574) 234-3167

Figure 2

200406

January
2006

Map Document: (Z:\200406_00\Finals\Figure-2-with watershed.mxd)
1/15/2006 -- 1:14:38 PM

III. Watershed Characteristics

A. Climate

Elkhart County experiences four well defined seasons. Air of both tropical and polar origin brings frequent changes in both temperature and humidity. The region experiences 36.7 inches of rainfall annually (period of record 1971-2000, Goshen, Indiana). Summer rainfall is normally experienced in afternoon thunderstorms. Although severe storms are rare, 26 tornadoes were reported in Elkhart County according to the National Climatic Data Center for the period of 1950 to 2002. Snowfall has occurred as early as October and as late as May. Typically, the largest amount of snowfall is in February. The normal maximum monthly temperature ranges from 31.5° F in January to 84.5°F in July. The normal minimum monthly temperature ranges from 17°F in January to 62.8°F in July. The maximum temperature recorded at Goshen, Indiana was 102°F on June 25th 1998. The minimum temperature recorded was –24°C on January 21, 1984. The maximum precipitation was 5.84" on July 8, 1951. The maximum calendar day snowfall was 14.0" on January 26th 1978.

B. Geology

The consolidated rocks underlying the watershed are of Ordovician age. These rocks consist of dolomite, dolomitic limestone and shale and are overlain by dolomitic limestone, shale and dolomite of Silurian age.[1]

The bedrock is overlain by thick, unconsolidated glacial deposits. These deposits are the results of several glacial periods, but predominantly the Wisconsin Glaciation and the subsequent recessions of the Saginaw Lobe. The thickness of the deposits ranges from 150 to 250 feet within the Puterbaugh Creek – Heaton Lake Watershed in Indiana.[1]

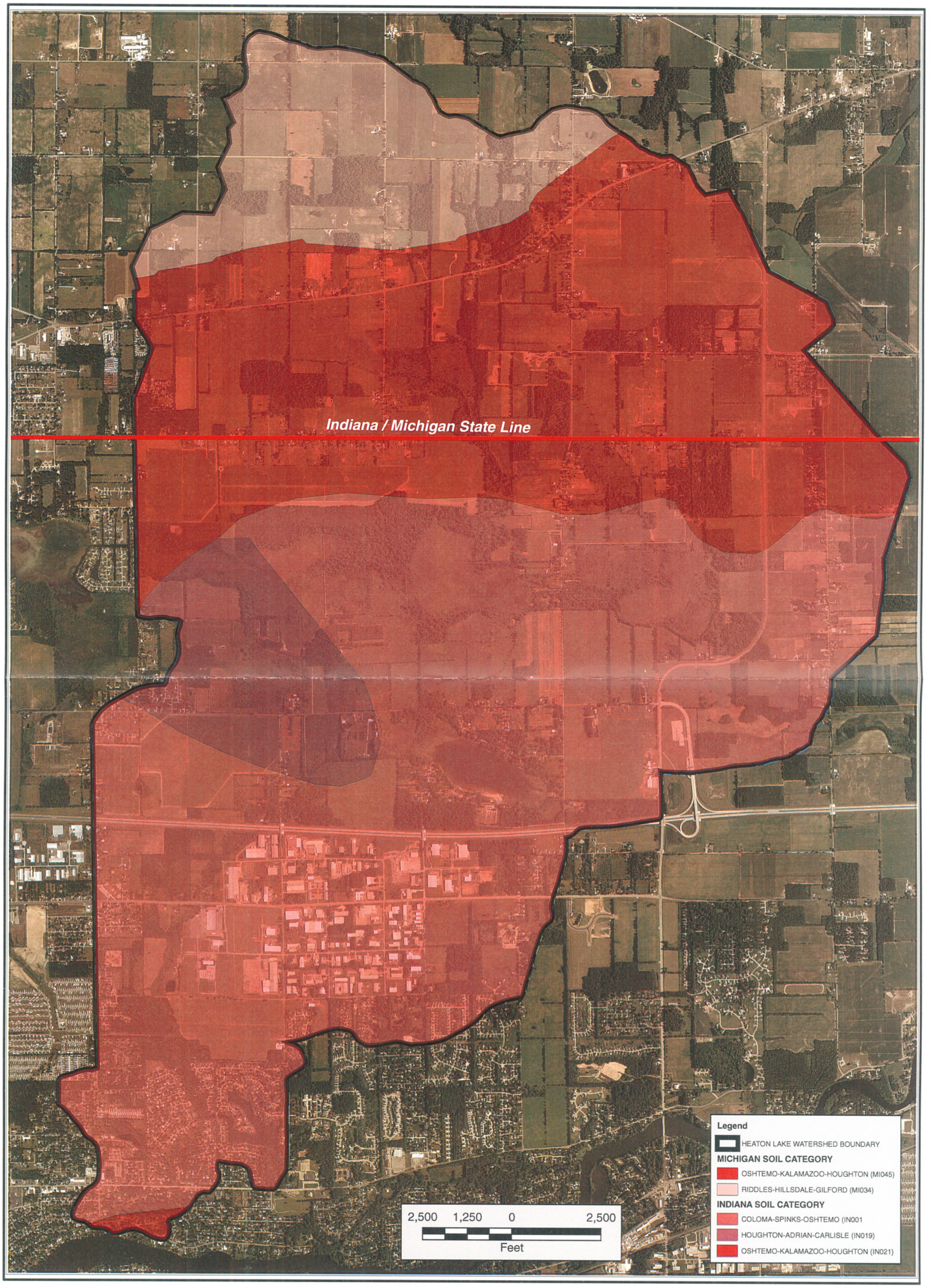
There is a surficial aquifer in the Indiana portion of the watershed.[1] In much of the watershed, the groundwater is within a few feet of the surface, especially during the wet season. With a high groundwater table, the creeks and ditches are typically fed by the groundwater in addition to surface runoff.[4]

C. Soils

The primary soil types within the Puterbaugh Creek – Heaton Lake Watershed consist of the Coloma-Spinks-Oshtemo and Riddles-Hillsdale-Gilford soils associations. The Coloma-Spinks-Oshtemo soils association generally consists of somewhat excessively drained to well drained soils and they have moderately rapid to rapid permeability rates. The available water capacity in the Coloma and Spinks soils is low and is moderate in the Oshtemo soil. The Coloma soils are poorly suited to cropland; but, crops such as corn, small grain and soybeans can be grown. The Riddles-Hillsdale-Gilford soils associations consists of well drained soils (Riddles) to very poorly drained soils (Gilford) and they have moderate to moderately rapid permeability rates. The Gilford soils can be considered prime farmland when they are drained due to the potential for water ponding.

The soil types for the watershed are illustrated in Figure 3. Table 1 presents the soil types within the watershed and their suitability for various uses.

Map Document: (Z:\200406_00\Finals\Figure-3.mxd)
1/15/2006 -- 1:04:19 PM



January 2006 | 200406 | Figure 3

LAWSON-FISHER ASSOCIATES P.C.
CONSULTING ENGINEERS
525 W. WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601
PH. (574) 234-3167

N W E S

Elkhart County 205(j) Grant
Puterbaugh Creek - Heaton Lake
Watershed Management Plan

Soil Type Map

Table 1
Watershed Soil Types

Soils Association	Acreage	% of Watershed	Farming	Sanitary
Coloma-Spinks-Oshtemo	5,411	49.6%	Not Prime Farmland (Coloma, Spinks) Prime Farmland (Oshtemo)	Limited Filtering Capacity
Houghton-Adrian-Carlisle	676	6.2%	Not Prime Farmland	Limited Filtering Capacity, Flow Percolation Rates, Ponding
Riddles-Hillsdale-Gilford	3,774	34.6%	Not Prime Farmland (Riddles, Hillsdale) Prime Farmland (Gilford – if drained)	Limited Filtering Capacity, Ponding (Gilford); Moderate Filtering Capacity, Slow Percolation Rates (Riddles)
Oshtemo-Kalamazoo-Houghton	1,048	9.6%	Not Prime Farmland (Houghton) Prime Farmland (Oshtemo, Kalamazoo)	Limited Filtering Capacity, Slow Percolation Rates

Reference: Soil Survey of Elkhart County, Indiana, USDA and NRCS, 2002.
Soil Survey of Cass County, Michigan, USDA and NRCS, 1991.

Table 1 indicates that all soils within the watershed are designated as being limited for on-site waste disposal systems. They are designated as being limited due to filtering capacity or due to restrictive permeability because of a high water table that contributes to ponding. When constructing on-site disposal systems in these conditions, specialized on-site systems are required, including mound systems or pressure dosed systems. These systems can be quite costly compared to the conventional on-site systems.

Soil erodibility has a direct effect on water quality. Erodible soils can be transported through wind and water erosion to surface waters. Nutrients and other pollutants are transported with the soils. Erodibility of the soils can be estimated using the factor Kw and Kf in the Universal Soil Loss Equation. K factors range from 0.02 being least susceptible to sheet and rill erosion by water to 0.69 being most susceptible to sheet and rill erosion by water. The K factors vary with depth. The Kw and Kf factors range from 0.05 (Coloma) to 0.17 (Spinks, Oshtemo) for the Coloma-Spinks-Oshtemo soils association (approximately 50% of the watershed)[4,5]. The Kw and Kf factors range from 0.15 to 0.24 for the Riddles-Hillsdale-Gilford soils association (approximately 35% of the watershed)[4,5]. Based on these values, the soils are slightly susceptible to sheet and rill erosion by water.

The majority of the soils in the watershed show a low susceptibility to wind erosion. Wind erodibility values range from 1 (most susceptible) to 8 (least susceptible). The Coloma-Spinks-Oshtemo soils association is in wind erodibility group 1 and 2 and the Riddles-Hillsdale-Gilford soils association is in wind erodibility group 3[4, 5].

D. Hydrology

The primary stream within the watershed is Puterbaugh Creek, which flows from just south of County Road 6 and discharges to the south into the St. Joseph River. A number of tributaries feed Puterbaugh Creek from the upper portion of the watershed. The Rhineheart Lateral, which flows under Stateline Road, and the Kindig/Kellog ditch, which flows under County Road 15, receive the majority of the flow from the Michigan portion of the watershed along with some flow from Indiana. These two laterals combine to flow into Bishop Ditch which then flows directly into Heaton Lake. There is only one outlet from Heaton Lake which when combined with the flow from Mather Ditch to the west of Heaton Lake flow into the Jacob Myers Ditch. The Jacob Myers Ditch then flows from just north of the East – West Indiana Toll Road to the headwaters of Puterbaugh Creek at County Road 6.

There are small wetlands areas within the watershed, as identified in the National Wetlands Inventory. These are shown in Figure 4. The National Wetlands Inventory abbreviation, description, and acreage of each type of wetland within the watershed are shown in Table 2.

Table 2
Wetlands within Puterbaugh Creek – Heaton Lake Watershed

Wetlands System and Classification [(1)]	*Acres, within Puterbaugh Creek – Heaton Lake Watershed*
Lacustrine Limnetic	99.5
Lacustrine Littoral	32.4
Palustrine Aquatic Bed	3.8
Palustrine Emergent/Scrub-Shrub	57.4
Palustrine Emergent	652.2
Palustrine Forested/Scrub-Shrub	63.2
Palustrine Forested	53.9
Palustrine Scrub-Shrub/Forested	7.8
Palustrine Scrub-Shrub/Emergent	88.9
Palustrine Scrub-Shrub	71.7
Palustrine Unconsolidated Bottom/Aquatic Bed	0.5
Palustrine Unconsolidated Bottom/Emergent	7.3
Palustrine Unconsolidated Bottom	19.5
Riverine Lower Perennial	3.2
Total	1,157 Acres

(1) Wetlands Definitions[6]

System:

Lacustrine – Includes wetlands and deepwater habitats with the following characteristics: (1) situated in a topographic depression or dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% area coverage; and (3) total area exceeds 20 acres.

Palustrine – All non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where ocean derived salinity is less than 0.5%.

Riverine – All wetlands and deepwater habitats contained within a channel with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean derived salts in excess of 0.5%.

Subsystem:

Limnetic – Deepwater habitats within Lacustrine System

Littoral - Wetlands habitats within Lacustrine System

Lower Perennial – Riverine wetlands where gradient is low and water velocities are slow. There is no tidal influence and some water flows throughout the year.

Classes and Subclasses:

Aquatic Bed – Wetland and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.

Emergent – Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. Vegetation is present for most of the growing season in most years. Usually dominated by perennial plants.

Forested – Characterized by woody vegetation that is 20 feet tall or taller.

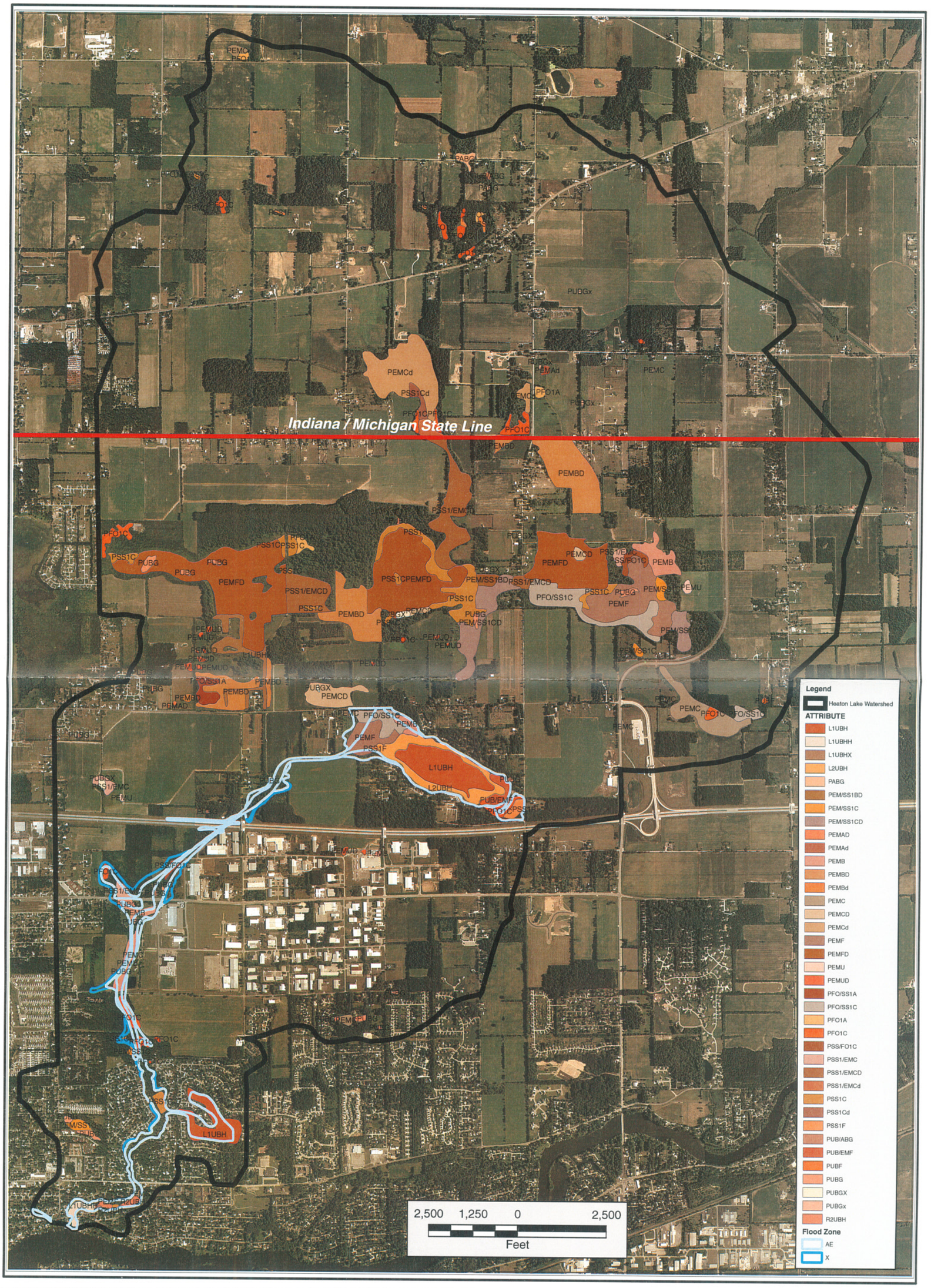
Scrub-Shrub – Characterized by areas dominated by woody vegetation less than 20 feet tall. Species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions.

Unconsolidated Bottom – Wetland and deepwater habitats with at least 25% cover of particles smaller than stones, and a vegetative cover less than 30%.

Wetlands are important features in the watershed, as they provide beneficial functions, including water quality improvement, floodwater storage, fish and wildlife habitat and biological productivity.

Wetlands make up approximately 10% - 11% of the total watershed.

Map Document: (Z:\200406_00\Finals\Figure-4.mxd)
1/15/2006 -- 1:10:17 PM



January 2006	200406	Figure 4	LAWSON-FISHER ASSOCIATES P.C. CONSULTING ENGINEERS 525 W. WASHINGTON AVENUE SOUTH BEND, INDIANA 46601 PH. (574) 234-3167	N W E S			Elkhart County 205(j) Grant Puterbaugh Creek - Heaton Lake Watershed Management Plan Hydrology Map

According to the FEMA Flood Insurance Rates Maps, Puterbaugh Creek and adjacent areas are within the 100-year flood elevation. The 100-year flood elevation ranges in width from about 37 feet at the Sellers Court crossing to approximately 350 feet immediately downstream of Heaton Lake. A detailed study of Puterbaugh Creek was conducted in the Flood Mapping, from its discharge point at the St. Joseph River to County Road 4 (just upstream of Heaton Lake). The 100-year flood elevation of Puterbaugh Creek downstream of County Road 6 is 761.4 feet NGVD 29 and the 100-year flood elevation at the point of discharge into the St. Joseph River is 742.5 feet NGVD 29.

E. Topography

The topography of the area in the northern portion of the watershed (north of U.S. 12 in Michigan) is typically characterized by gently rolling hills. South of U.S. 12 and into Indiana, the topography of the area is relatively flat. The elevation of the watershed ranges from elevation 750 NGVD 1929 near the discharge point at the St. Joseph River to 880 NGVD 1929 in the upper reaches of the watershed.

F. Land Use

The existing land use varies within the watershed. The lower reaches of the watershed are primarily residential with some industrial development. The upper portions of the watershed are primarily agricultural or undeveloped. Figure 5 shows the land use within the watershed. Land use was determined utilizing aerial photographs and field verification. Table 3 summarizes the land use by type. This land use information was developed using USGS Quadrangle maps and 2003 aerial photography and field verified as part of the 205(j) Grant Project.

Table 3
Land Use

Land Use	*Acreage*	*Percent*
Undeveloped (Indiana)	1,757	16.1%
Undeveloped (Michigan)	492	4.5%
Agricultural (Indiana)	2,488	23%
Agricultural (Michigan)	2,359	21.6%
Residential (Indiana)	2,045	18.7%
Residential (Michigan)	826	7.6%
Commercial (Indiana)	82	0.7%
Manufacturing (Indiana)	727	6.6%
Institutional – School (Indiana)	16	0.1%
Institutional – Church (Indiana)	2	0.0%
Ideal Beach (Indiana)	27	0.3%
Heaton Lake	88	0.8%
Total	10,909	100%

The developed portions of the watershed are divided by land use (residential, commercial, manufacturing and institutional).

A septic permit database that includes all of the septic permit applications filed with the Elkhart County Health Department from 1990 to 2004 has been received. The data from the septic permits will be incorporated into a database and geocoded for their placement on the Figures. See Figure 5 for the location of the septic permits that were issued from 1990 to 2004. A similar septic database for Cass County, Michigan was not available.

Elkhart County zoning is shown in Figure 6. Zoning within Elkhart County is regulated through the County Zoning Ordinance. Zoning is used to guide the types of land use and development that can occur in specific geographic areas. Zoning allows development to occur in targeted areas, limits development in other areas, and provides protection for land conservation areas. With a zoning ordinance in place, development is targeted where public facilities and services are nearby and/or could be provided at a reasonable cost and a specific time frame. Zoning classifications can be utilized in water quality management strategies, by focusing best management practices, by land use, and protecting critical resource areas. The acreage of each zone classification is shown below in Table 4. In comparing the actual land use with the zoning classifications, it can be seen that there is more land that is developed than is zoned for development (commercial, manufacturing or residential).

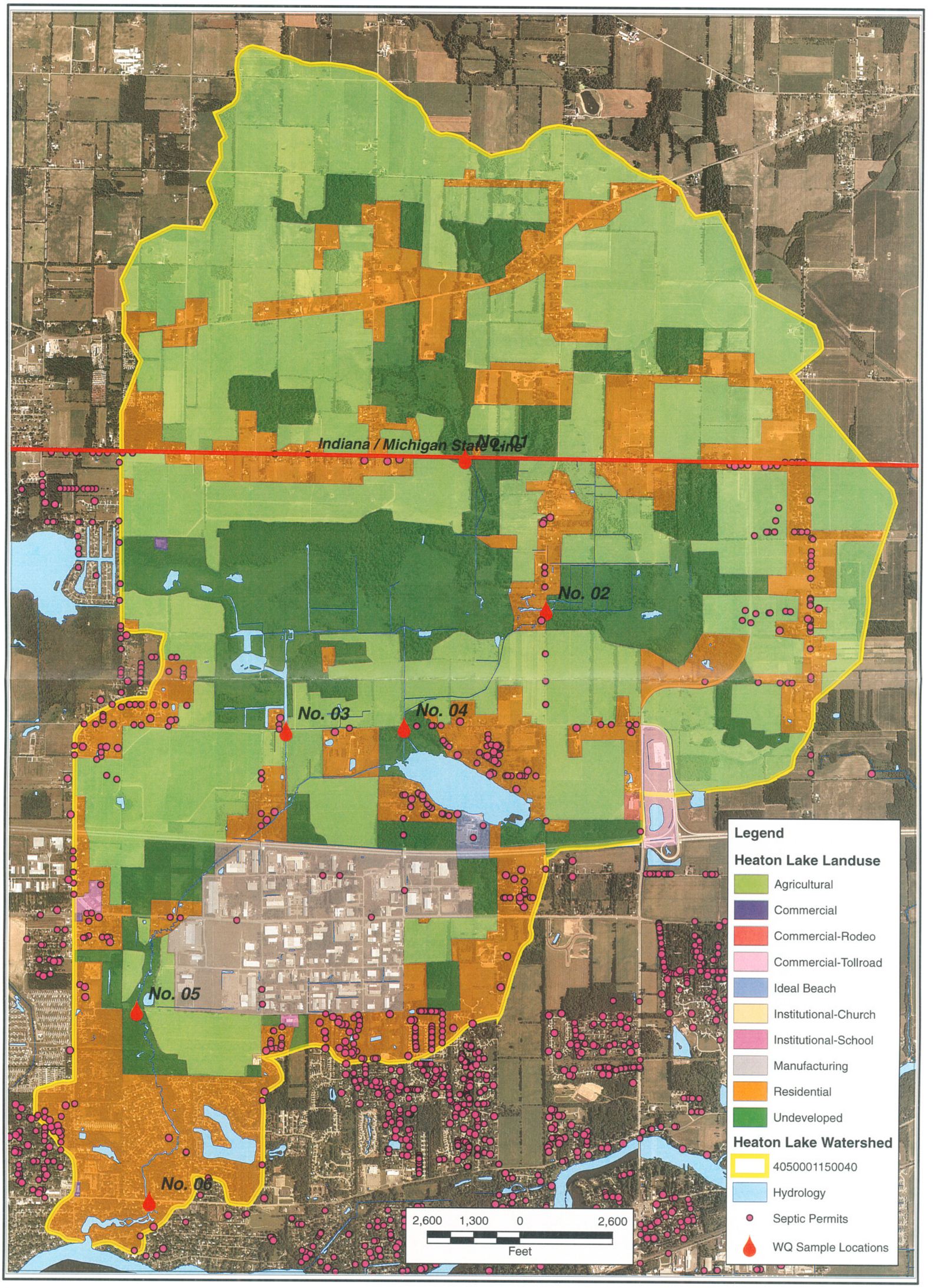
Table 4
Watershed Zoning Areas

Zone	*Acreage*	*Percent*
Agricultural	5,243	48.1%
Commercial	6	0.1%
Manufacturing	669	6.1%
PUD	651	6%
Single Family	2,860	26.2%
Two-Family	398	3.6%
Multi Family	42	0.4%
Water	90	0.8%
Elkhart Corporate Limits	950	8.7%

G. History

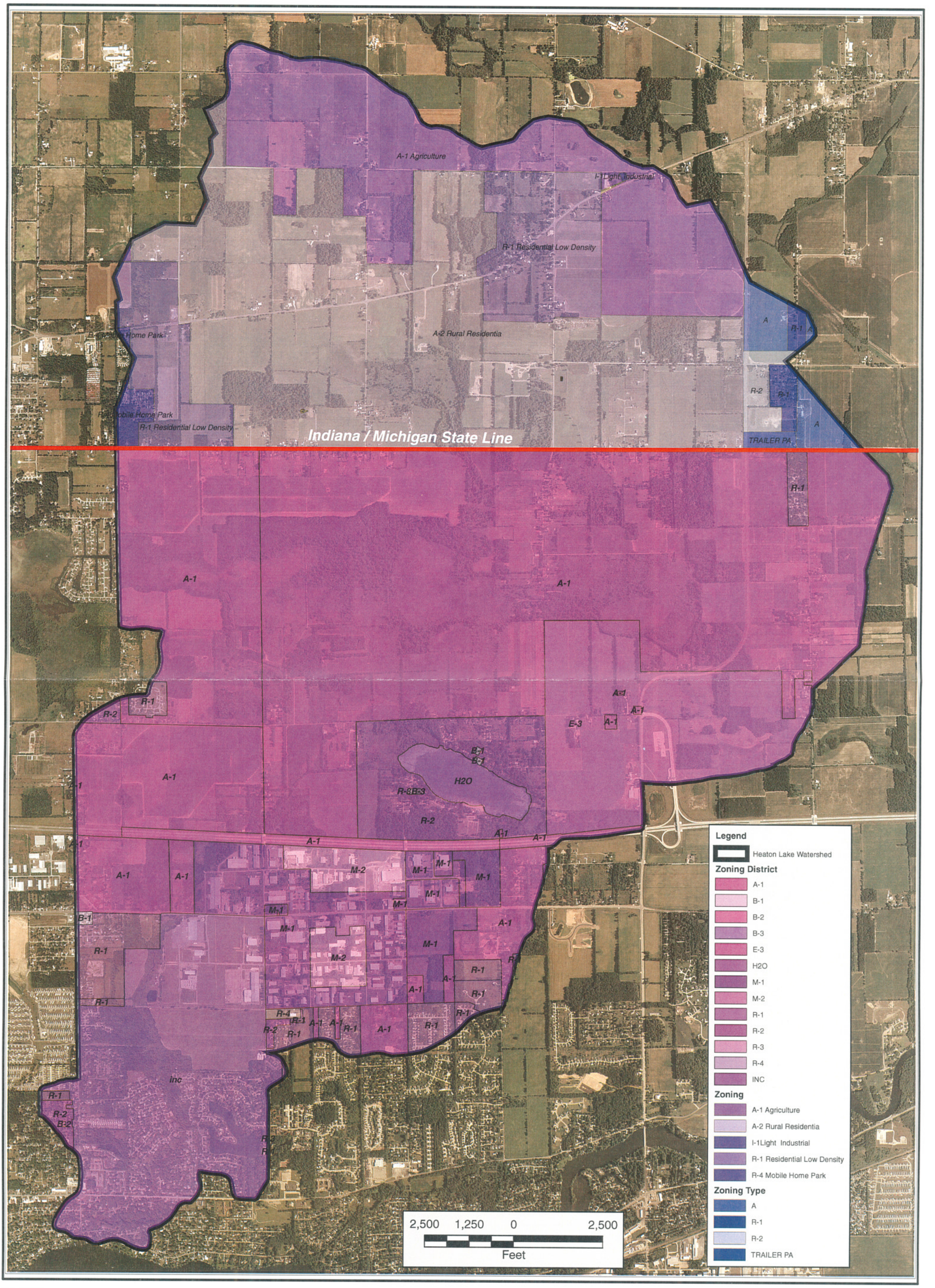
Prior to the exploration and settlement by the Europeans, the Miami Indians resided in what is now Elkhart County. The area was explored by France's Sieur de La Salle in about 1680. The area was later settled by French settlers. The French were displaced by English settlers following the French and Indian War (1754-1763). After the American Revolutionary War, what is now Elkhart County was conquered for the United States as part of the Indiana Territory.[2] Elkhart County was established by the Indiana Legislature in 1830, with the County seat being Dunlap (located immediately south of the Puterbaugh Creek – Heaton Lake Watershed).

Map Document: (Z:\200406_00\Finals\Figure-5.mxd)
1/15/2006 -- 1:16:10 PM



January 2006	200406	Figure 5	LAWSON-FISHER ASSOCIATES P.C. CONSULTING ENGINEERS 525 W. WASHINGTON AVENUE SOUTH BEND, INDIANA 46601 PH. (574) 234-3167	N W E S			Elkhart County 205(j) Grant Puterbaugh Creek - Heaton Lake Watershed Management Plan Land Use Map

Map Document: (Z:\200406_00\Finals\Figure-7.mxd)
1/15/2006 -- 1:39:19 PM



January 2006	200406	Figure 6	LAWSON-FISHER ASSOCIATES P.C. CONSULTING ENGINEERS 525 W. WASHINGTON AVENUE SOUTH BEND, INDIANA 46601 PH. (574) 234-3167	N W E S			Elkhart County 205(j) Grant Puterbaugh Creek - Heaton Lake Watershed Management Plan Zoning Map

The watershed is located within Osolo and Washington Civil Townships. The watershed area historically has been primarily agricultural with the main crops being corn and soybeans.

H. Endangered Species

The Indiana Department of Natural Resources provides information on endangered, rare or threatened species, high quality natural areas and natural areas in Indiana in its Natural Heritage Center Database. The Indiana Natural Heritage Data Center database is designed to provide information about Indiana's diversity of natural ecosystems, species, landscape features, and outdoor amenities, and to assure adequate methods for evaluating this information and setting sound land protection priorities. The inventory is a continuous process, becoming an increasingly valuable tool for decision makers and scientists as it progresses. Because the IDNR relies on observations from individuals, it does not document every occurrence of a particular species or habitat. Conversely, a listing of a species does not guarantee that the particular species is present.

The results of the database search for the Puterbaugh Creek – Heaton Lake watershed are attached in Appendix B.

IV. Identified Problems

A. Water Quality Assessment

The water quality within the Puterbaugh Creek – Heaton Lake Watershed was evaluated using a variety of sources, water quality sampling results, historical water quality sampling results and previous studies.

2004 ECC 205(j) Grant Project Water Quality Sampling

The watershed was sampled at 6 locations during the project. The sampling locations are described in Table 5 The sampling locations as well as drainage area boundaries are shown in Figure 7.

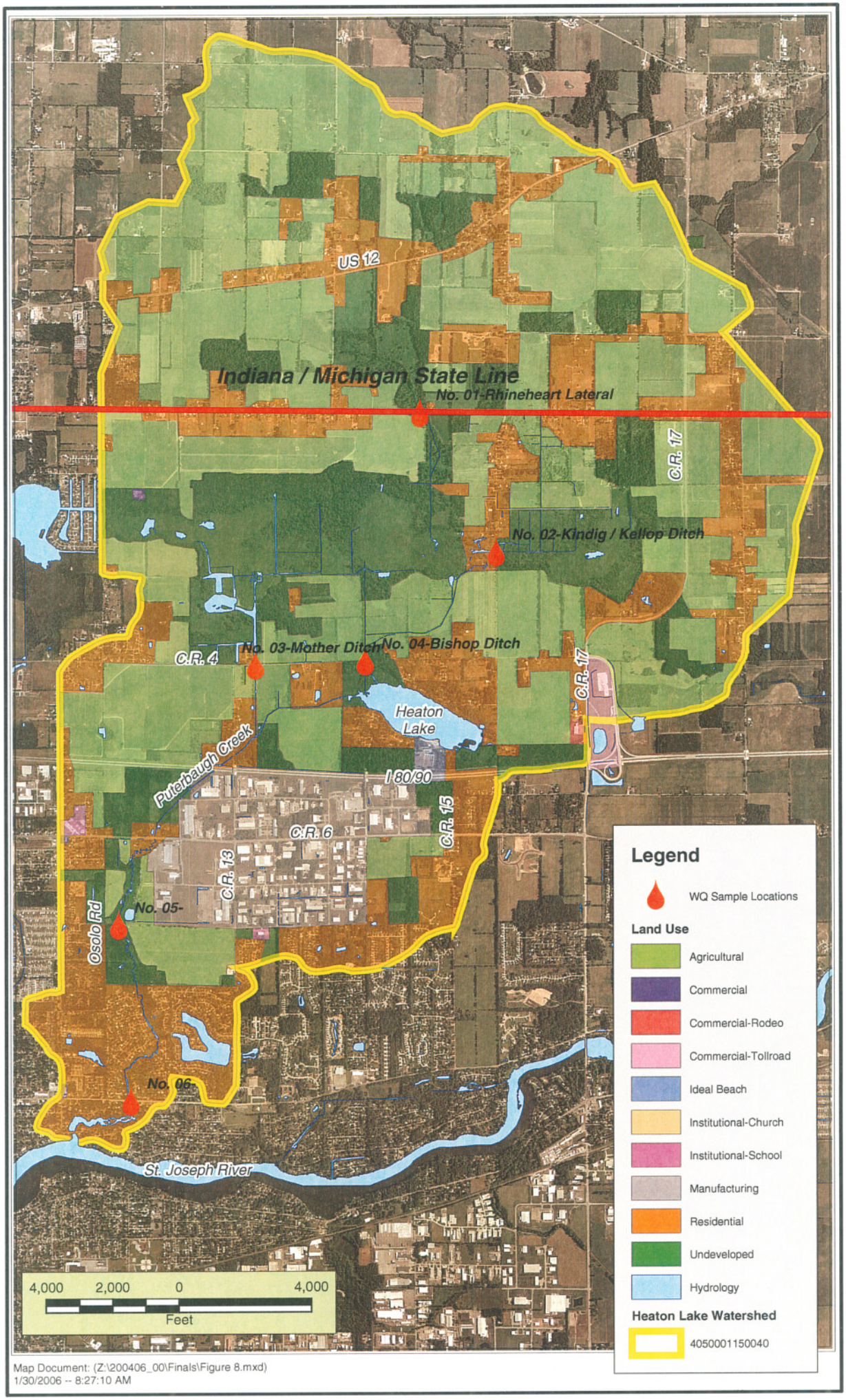
Table 5
Puterbaugh Creek – Heaton Lake Water Quality Sampling Locations

Site #	Location	Stream Name	Approximate Drainage Area (Acres)
1	State Line Road	Rhineheart Lateral	956
2	County Road 15	Kindig/Kellog	2,913
3	County Road 4	Mather Ditch	2,291
4	County Road 4	Bishop Ditch	4,693
5	County Road 106	Puterbaugh Creek	7,897
6	Bristol Street	Puterbaugh Creek	10,909

Samples were collected for two dry weather events and two wet weather events. The sampling procedures are described in detail in the Quality Assurance Project Plan (QAPP) for Puterbaugh Creek – Heaton Lake Watershed Management Plan, Elkhart County, Indiana ARN 03-671 (May 2004).

Samples were analyzed for the following parameters:

Dissolved Oxygen (DO)
Temperature
pH
Conductivity
Total Dissolved Solids (TDS)
Total Suspended Solids (TSS)
Ammonia-Nitrogen (NH_3-N)
Nitrate-Nitrogen (NO_3-N)
Total Kjeldahl Nitrogen (TKN)
Orthophosphate
Total Phosphorus
Surfactants (MBAS)
E. Coli



Map Document: (Z:\200406_00\Finals\Figure 8.mxd)
1/30/2006 -- 8:27:10 AM

Elkhart County 205(j) Grant
Puterbaugh Creek - Heaton Lake
Watershed Management Plan

Water Quality Sampling Locations

N
W E
S

LAWSON-FISHER ASSOCIATES P.C.
CONSULTING ENGINEERS
525 W. WASHINGTON AVENUE
SOUTH BEND, INDIANA 46601
PH. (574) 234-3167

Figure 7

200406.00

Jan. 2006

The sampling events during the water sampling collection are summarized below in Table 6.

Table 6
Sampling Event Summary

Date	Rainfall (inches)*	Type
6/10/04	0.98	Wet
9/13/04	-	Dry
9/16/04	0.64	Wet
9/21/04	-	Dry

*48 hour total.

The results of the sampling are summarized in Table 7 Water quality data is included in Appendix C.

Heaton Lake Data

Secchi disk data has been gathered at Heaton Lake by volunteers since 1994. The Secchi disk is a round disk that is lowered into the lake until the observer loses site of the disk. The disk is then raised until it reappears. The depth at which the disk disappears and reappears to the observer is the Secchi disk depth. The Secchi disk measurement of water clarity allows for a simplistic approach to evaluating the transparency of water. The following Table 8 outlines the averages of the Secchi disk readings for the period of record:

Table 8
Heaton Lake Secchi Disk Data

Annual Summaries										
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Average (feet)	11.9		10.0	5.5	7.6	10.7	7.6			7.1

Elkhart – South Bend Fish Community Monitoring – 2000 and 2003 Annual Report

Elkhart Public Works and Utilities conducted a series of studies monitoring the fish communities of St. Joseph River, Elkhart River and their tributaries in St. Joseph and Elkhart Counties. Puterbaugh Creek was one of the tributaries sampled. The Index of Biotic Integrity or IBI was determined at various locations and is a tool that is used to assess water quality using fish community information. The IBI is useful in translating complex fish community information into a more understandable format for non-biologists. In addition, the Qualitative Habitat Evaluation Index (QHEI) was used to assess the available habitat at all the sampling locations. The QHEI assists in determining the extent to which the IBI scores are being affected by habitat.

Table 7
Elkhart County 205(j) Grant Project
Water Quality Monitoring Results

	Water Quality Guidelines					6 - 9	Varies by month		750 mg/L		5 mg/L		235 CFU/100 mL		Varies with pH and Temperature				
	No.	Sampling Location	Date	Time	Ambient Temp. (°C)	Weather Condition	pH	Water Temp. (°C)	Cond. (µS/cm)	TDS	Color	DO (mg/L)	DO (%)	E. Coli	TKN (mg/L)	Ammonia (mg/L)	Nitrate (mg/L)	Orthophosphorus (mg/L)	Total Phosphorus (mg/L)	TSS (mg/L)	MBAS (Surfactants) (mg/L)
Wet Weather Sample	1	Rhineheart Lateral	6/10/2004				7.72	19.2	373	190	Light Brown	6.97	75.1	11000	1.8	0.3	2.5	<0.05	0.37	35	<0.1
	2	Kindig/Kellog	6/10/2004	2:45 PM	21.7	Light Rain	7.22	21.3	210	107	Rust/Brown	1.35	15.1	1360	1.6	0.2	<0.1	<0.05	0.27	6	0.21
	3	Mather Ditch	6/10/2004	3:00 PM	21.7	Overcast	8.07	23.2	388	197	Clear	6.85	74.6	280	0.49	<0.05	<0.1	<0.05	<0.05	18	20
	4	Bishop Ditch	6/10/2004		21.7	Light Rain	7.57	20.5	361	184	Light Brown	3.88	43.8	1640	1.3	0.3	<0.1	<0.05	0.41	5	0.14
	5	Puterbaugh Creek	6/10/2004		21.7	Overcast	7.97	21.5	385	196	Clear	7.01	79.6	360	0.99	<0.05	<0.1	<0.05	0.24	8	<0.1
0.98 inches	6	Puterbaugh Creek	6/10/2004	3:00 PM	21.7	Overcast	8.08	21.2	396	201	Clear	7.95	89.2	900	1.1	0.4	0.12	<0.05	0.34	2	0.12
	Duplicate	Rhineheart Lateral	6/10/2004	2:25 PM		Light Rain	7.72	19.2	373	190	Light Brown	6.97	75.1	11000	1.8	0.4	2.5	<0.05	0.26	32	0.12
	Trip Blank		6/10/2004											<1	0.72	0.2	0.23	<0.05	<0.1	<1	<0.1
	No.	Sampling Location	Date	Time	Ambient Temp. (°C)	Weather Condition	pH	Water Temp. (°C)	Cond. (µS/cm)	TDS	Color	DO (mg/L)	DO (%)	E. Coli	TKN (mg/L)	Ammonia (mg/L)	Nitrate (mg/L)	Orthophosphorus (mg/L)	Total Phosphorus (mg/L)	TSS (mg/L)	MBAS (Surfactants) (mg/L)
Wet Weather Sample	1	Rhineheart Lateral	9/16/2004	7:30 AM	21.1	Sunny	8.4	18.6	430	300	Light Brown	4.7	50.6	21400	2.4	<0.05	0.39	0.12	0.46	24	0.13
	2	Kindig/Kellog	9/16/2004	8:00 AM	21.1	Sunny	7.6	19.2	420	320	Light Brown	0.26	2.8	1540	4.4	<0.05	<0.1	0.067	0.45	29	0.27
	3	Mather Ditch	9/16/2004	8:35 AM	21.1	Sunny	8.4	23.4	420	280	Clear	8.3	97.2	68	0.34	<0.05	<0.1	0.054	0.16	1	<0.1
	4	Bishop Ditch	9/16/2004	8:15 AM	21.1	Sunny	7.8	18.1	500	330	Light Green	1.92	16.6	450	0.71	<0.05	<0.1	0.13	0.24	4	<0.1
0.64 inches	5	Puterbaugh Creek	9/16/2004	8:55 AM	21.1	Sunny	8	17.6	500	310	Clear - Light Green	6.48	67.5	1100	<0.1	<0.05	0.13	0.055	0.2	<1	<0.1
	6	Puterbaugh Creek	9/16/2004	9:10 AM	21.1	Sunny	8.1	17.1	510	300	Clear - Light Green	6.98	72.8	3600	0.52	<0.05	0.18	0.054	0.22	3	<0.1
	Duplicate	Bishop Ditch	9/16/2004	8:15 AM	21.1	Sunny	7.8	18.1	480	300	Light Green	1.92	16.6	500	0.76	<0.05	<0.1	0.13	0.23	2	<0.1
	Trip Blank		9/16/2004						7.9	<2				<1	<0.1	<0.05	<0.1	<0.05	<0.05	<1	<0.1
	No.	Sampling Location	Date	Time	Ambient Temp. (°C)	Weather Condition	pH	Water Temp. (°C)	Cond. (µS/cm)	TDS	Color	DO (mg/L)	DO (%)	E. Coli	TKN (mg/L)	Ammonia (mg/L)	Nitrate (mg/L)	Orthophosphorus (mg/L)	Total Phosphorus (mg/L)	TSS (mg/L)	MBAS (Surfactants) (mg/L)
	1	Rhineheart Lateral	9/13/2004	9:00 AM	24.5	Sunny	8.1	14.9	580	370	Light Brown	7.27	72	700	3.2	<0.05	0.68	0.09	0.29	140	0.27
	2	Kindig/Kellog	9/13/2004	9:10 AM	24.5	Sunny	7.4	16.3	410	330	Light Brown	0.26	2.6	84	1.8	<0.05	<0.1	<0.05	0.24	8	0.27
	3	Mather Ditch	9/13/2004	9:40 AM	24.5	Sunny	8.2	22.1	410	280	Clear	9.9	113.5	11	0.23	<0.05	<0.1	<0.05	0.23	<1	0.2
	4	Bishop Ditch	9/13/2004	9:30 AM	24.5	Sunny	7.7	14.8	520	340	Yellowish - Green	1.12	10.9	230	0.62	<0.05	<0.1	0.15	0.23	2	0.1
Dry Weather Sample	5	Puterbaugh Creek	9/13/2004	9:55 AM	24.5	Sunny	8	18.3	490	310	Clear	7.04	74.8	110	0.64	<0.05	<0.1	0.07	0.28	2	<0.1
	6	Puterbaugh Creek	9/13/2004	10:10 AM	24.5	Sunny	8	16.9	500	300	Clear	7.59	78.3	280	0.43	<0.05	0.15	0.074	0.21	12	<0.1
	Duplicate	Kindig/Kellog	9/13/2004	9:10 AM	24.5	Sunny	7.4	16.3	410	330	Light Brown	0.26	2.6	56	2.8	<0.05	<0.1	<0.05	0.24	5	0.2
	Trip Blank		9/13/2004						<1	10				<1	<0.1	<0.05	<0.1	<0.05	0.13	<1	<0.1
	No.	Sampling Location	Date	Time	Ambient Temp. (°C)	Weather Condition	pH	Water Temp. (°C)	Cond. (µS/cm)	TDS	Color	DO (mg/L)	DO (%)	E. Coli	TKN (mg/L)	Ammonia (mg/L)	Nitrate (mg/L)	Orthophosphorus (mg/L)	Total Phosphorus (mg/L)	TSS (mg/L)	MBAS (Surfactants) (mg/L)
	1	Rhineheart Lateral	9/21/2004	7:00 AM	15.6	Sunny	8.2	10.6	590	390	Light Brown	6.86	66.5	3400	0.86	<0.05	0.46	0.07	0.16	27	0.13
	2	Kindig/Kellog	9/21/2004	7:10 AM	15.6	Sunny	8.1	12.6	430	340	Brown	1.01	9.6	126	1.7	<0.05	<0.1	0.073	0.4	12	0.38
Dry Weather Sample	3	Mather Ditch	9/21/2004	7:40 AM	15.6	Sunny	8.4	18.5	420	300	Clear	8.98	95.6	32	<0.1	<0.05	<0.1	0.077	0.12	<1	0.21
	4	Bishop Ditch	9/21/2004	7:30 AM	15.6	Sunny	8	12.4	450	330	Light Brown	2.46	21.5	118	1.1	<0.05	<0.1	0.1	0.19	2	0.21
	5	Puterbaugh Creek	9/21/2004	8:00 AM	15.6	Sunny	8.2	12.3	520	330	Light Green	7.84	73.2	580	0.22	<0.05	<0.1	0.087	0.24	1	0.16
	6	Puterbaugh Creek	9/21/2004	8:15 AM	15.6	Sunny	8.2	12.7	490	360	Clear - Light Green	8.47	79.7	420	0.34	<0.05	0.22	0.092	0.21	5	<0.1
	Duplicate	Rhineheart Lateral	9/21/2004	7:00 AM	15.6	Sunny	8.2	10.6	590	400	Light Brown	6.86	66.5	3800	0.78	<0.05	0.43	0.12	0.32	23	0.14
	Trip Blank		9/21/2004						13.7	12				<1	<0.1	<0.05	<0.1	<0.07	<0.05	<1	<0.1

Puterbaugh Creek was evaluated for its IBI at Reedy Drive in 2003 and at County Road 8 in 2000. The creek was evaluated for its QHEI at Reedy Drive and County Road 4 in the 2003 Report. IBI scores can range from 12 (very poor) to 60 (very good). QHEI scores can range from 0 (very poor) to 100 (excellent). The IBI and QHEI scores for Puterbaugh Creek are shown in Table 9.

Table 9
Fish Community Monitoring Index of Biotic Integrity (IBI) and Qualitative Habitat Evaluation Index (QHEI) for Puterbaugh Creek Locations

Site	*1998 IBI*	*1999 IBI*	*2000 IBI*	*Average IBI*
County Road 8	38	41	37	39

Site	*2001 IBI*	*2002 IBI*	*2003 IBI*	*Average IBI*	*2003 QHEI Score*
County Road 4					27
Reedy Drive	33	41	36	37	63

The fish community condition in this stream is fair and basically stable from site to site (Foy 2003). The 2000 and 2003 Elkhart – South Bend Fish Community Monitoring Annual Reports are included in Appendix D.

Water Quality Discussion

There are various standards and guidelines for some of the parameters monitored for the watershed management plan. The water quality standards for the parameters tested are shown in Table 10 Some of these standards are not appropriate for the regulation of Puterbaugh Creek (such as drinking water standards, since the Creek is not used as a source of drinking water); however, they provide a standard by which to evaluate the water quality.

Table 10
Water Quality Standards/Guidelines

Water Quality Parameter	*Standard*	*Source/Standard*
Dissolved Oxygen	5 mg/L daily average 4 mg/L minimum	327 IAC 2
Temperature	Varies by month	327 IAC 2
Total Dissolved Solids	750 mg/L	327 IAC 2
Chlorides	860 mg/L Maximum	327 IAC 2
pH	6-9	327 IAC 2
E. Coli	235 CFU/100 mls Primary Contact Max Daily Conc.	327 IAC 2
	125 CFU/100 mls Primary Contact 30 Day Geometric Mean	327 IAC 2
Nitrate	10 mg/L	Drinking Water Standards
Ammonia	Varies with pH and Temperature	327 IAC 2
Total Phosphorus	0.04 mg/L Daily Maximum	327 IAC 2 – evaluated during IDEM triennial review at Great Lakes drinking water intakes (not a WQ Standard)

E. Coli

E. Coli measured during the Elkhart County 205(j) Grant Project sampling exceeded the standard of 235 CFU/100 mls maximum daily concentration in all but one sample during wet weather events. The standard was exceeded at Site No. 1 (State Line Road) and Site No. 6 (Puterbaugh Creek) during both dry weather events. The standard was exceeded at Site No. 5 (Puterbaugh Creek) during the September 21, 2004 dry weather event. *E. Coli* is an indicator organism which may indicate the presence of human or animal wastes. The USEPA uses *E. Coli* measurements to determine whether fresh water is safe for recreation. The presence of *E. Coli* within the Puterbaugh Creek – Heaton Lake Watershed is most likely due to a number of sources, including failed septic systems, livestock and or wildlife. However, the *E. Coli* contribution from the lower portion of the watershed is most likely from domestic sources, not agricultural. The lower portion of the watershed has a significant number of residences on septic systems, and a relatively small amount of livestock within the watershed. The *E. Coli* contribution from the upper portion of the watershed is mainly due to agricultural sources. In almost every case, the wet weather *E. Coli* concentrations were significantly higher than the dry weather concentrations, indicating a significant contribution of *E. Coli* from surface runoff.

Total Dissolved Solids

In all cases, the measurements for the Puterbaugh Creek/Heaton Lake Watershed were less than the standard of 750 mg/L for total dissolved solids. High total dissolved solids can be an indication of domestic wastewater pollution or pollution associated with livestock or wildlife.

Nutrients

In general, the nitrogen and phosphorus levels within the Puterbaugh Creek – Heaton Lake Watershed are moderate to high. This is not unexpected due to the level of agricultural land use within the watershed.

- ### Nitrogen

  Nitrogen is a nutrient that is necessary for the growth of all living organisms. The water quality sampling results for nitrates were all less than 10 mg/L, the drinking water standard. There are several potential sources of nitrates in surface water including industrial pollutants and nonpoint – source runoff from heavily fertilized cropland lawns.

  Nitrates are a primary component of most fertilizers. Additionally, nitrates are formed by the oxidation of ammonia (NH_3-N) a component of human and animal wastes.

The ammonia results in the water quality samples taken during the two (2) September 2004 dry weather events and the one (1) September 2004 wet weather event were less than the detection limit of 0.05 mg/L. However, some of the results of the samples gathered during the first wet weather event taken during June 2004 were above the water quality standards for unionized ammonia, which ranges from 0.0075 mg/L at a pH of 6.5 and temperature of 0 C, to 0.2137 mg/L at a pH of 9 and a temperature of 30 C. While these values do not meet the standard, the concentrations, in general, do not increase throughout the Puterbaugh Creek – Heaton Lake Watershed. A primary source of ammonia nitrogen is the urea component of human and animal wastes.

Total Kjehldahl Nitrogen (TKN) is a measure of NH_3-N and organic nitrogen. While there is no standard on TKN, a comparison of the TKN and NH_3-N results provides an insight on the amount of organic nitrogen.

- *Phosphorus*

  There is no Indiana State Standard for phosphorus within Puterbaugh Creek and its tributaries. However, phosphorus is monitored during IDEM's triannual review process at drinking water intakes in Lake Michigan. The daily maximum for this review is 0.04 mg/L. The total phosphorus results exceeded the 0.04 mg/L standard in all samples. High levels of phosphorus can contribute to algal blooms in lakes. However, similar to ammonia-nitrogen, the levels of phosphorus did not increase throughout the Puterbaugh Creek – Heaton Lake Watershed. Sources of phosphorus include human and animal wastes, fertilizers and decaying organic matter (i.e. leaves and foliage).

Temperature

All temperature measurements were within the monthly temperature standards set forth in the IAC.

Dissolved Oxygen

Dissolved oxygen did not meet the state standards during all four (4) sampling events at the County Road 15 (Site No. 2) sampling site and the County Road 4 (Site No. 4) sampling site. Dissolved oxygen at the State Line Road (Site No. 1) sampling site was below the dissolved oxygen standard only during the September 16, 2004 wet weather event. Dissolved oxygen is critical to the health of aquatic species in a water body. Low dissolved oxygen can be an indication of a pollutant source, especially human and animal wastes.

MBAS

MBAS is a measure of surfactants, primarily occurring from sources of commercial or domestic laundry operations or other cleansing operations. For the purposes of this study, it is being used as an indicator of domestic wastewater. Raw wastewater has a typical range of 1 – 20 mg/L MBAS. Natural waters typically have less than 0.1 mg/L MBAS. Many of the sampling locations exhibited MBAS levels greater than 0.1 mg/L indicating a potential for domestic wastewater contribution.

Estimated Annual Pollutant Loading

Based on the water quality analyses performed at the 6 sampling locations, annual pollutant loading was estimated for the following parameters:

Puterbaugh Creek and its tributaries are not gauged, therefore, estimated annual runoff was used to estimate the volume of flow at each of the sampling locations. Average annual runoff from USGS Gauging Station 04101000 (St. Joseph River at Elkhart, Indiana) of 13.69 inches (1948-2004 period of record) was utilized to estimate the flow volume. The results of the water quality analyses were averaged and applied to the runoff to estimate the annual pollutant loading. The results of this analysis are included as Table 11 and are presented as lb. per year for the watershed and normalized to lb. per acre.

Table 11
Estimated Pollutant Loadings

Sampling Location	*1 Rhineheart Lateral*	*2 Kindig/ Kellog*	*3 Mather Ditch*	*4 Bishop Ditch*	*5 Puterbaugh Creek*	*6 Puterbaugh Creek*
Approximate Drainage Area (Acres)	956	2,913	2,291	4,693	7,897	10,909
Estimated Annual Flow Volume (MG/yr)	341	1,039	817	1,675	2,818	3,893
Average TDS (mg/L)	307	285	264	297	287	290
TDS Loading (lb/yr)	873,000	2,476,000	1,803,000	4,148,000	6,737,000	9,429,000
TDS Loading (lb/acre/yr)	913	850	787	884	853	864
Average *E. Coli* (cfu/100 ml)	8,550	633	98	588	538	1,300
E. Coli Loading (cfu/yr)	1.1xE14	2.5xE13	3.0xE12	3.7xE13	5.7xE13	1.9xE14

Table 11
Estimated Pollutant Loadings (Continued)

Sampling Location	1 Rhineheart Lateral	2 Kindig/ Kellog	3 Mather Ditch	4 Bishop Ditch	5 Puterbaugh Creek	6 Puterbaugh Creek
E. Coli Loading (cfu/acre/yr)	1.2xE11	8.6xE9	1.3xE9	7.9xE9	7.3xE9	1.8xE10
Nitrate (mg/L	1.16	<0.1	<0.1	<0.1	<0.11	0.17
Nitrate Loading (lb/yr)	3,300	*	*	*	*	5,400
Nitrate Loading (lb/acre/yr)	3.5	*	*	*	*	0.5
Average Total P (mg/L)	0.31	0.32	<0.14	0.26	0.24	0.25
Total P Loading (lb/yr)	880	2,780	*	3,630	5,640	7,960
Total P Loading (lb/acre/yr)	0.92	0.95	*	0.77	0.71	0.73
Average TSS (mg/L)	47	12	<5.3	3	<3	6
TSS Loading (lb/yr)	133,000	104,000	*	42,000	*	179,000
TSS Loading (lb/acre/yr)	139	36	*	9	*	16
Average MBAS (mg/L)	0.15	0.27	5.2	*	*	*
MBAS Loading (lb/yr)	427	2,307	35,474	*	*	*
MBAS Loading (lb/acre/yr)	0.45	2.4	37.1	*	*	*

*Loadings not estimated where analysis results were below detection limits for 1 or more samples.

B. Pollutant Sources and Stressors

- *Failing On-Site Septic Systems*

The water quality sampling indicates fairly high levels of *E. Coli*, an indicator of human or animal wastes. Additionally, in some areas, the high *E. Coli* levels are combined with elevated MBAS (surfactants) indicating the presence of domestic wastes (soaps and detergents). The high levels of E. coli combined with the surfactants greater than 0.1 indicate a domestic source of contamination. The predominant land uses within the sub-basins monitored are agricultural and rural/suburban residential. There is currently no publicly owned treatment facility serving most of the watershed, with exception of the very southern portion which is served by the City of Elkhart. The location of the septic permit applications (1990-2004) shown in Figure 5, further suggest the dominance of on-site septic systems in the watershed. A geographic database of septic permits did not exist for the portion of the watershed in the State of Michigan, however, this area is also not served by a public sewer system, and therefore all facilities are served by on-site systems. The limited capacity of the existing soils for septic systems also leads to the conclusion that there may be failing septic systems within the area. With a limited depth to water table, septic tank effluent may intercept groundwater or surface water sources, without receiving adequate treatment, resulting in contaminated ground or surface waters.

As development increases and on-site systems are used, the potential for failing systems increases. While this management plan has focused on the impairments to the surface water within the Puterbaugh Creek – Heaton Lake Watershed, the groundwater quality is also at risk due to failing on-site septic systems. Most of the homes within the watershed have individual wells as their water supply.

- *Direct Discharge of Septic Tank Effluent*

Because of the poor soils, older residences may have direct discharges of their septic tank effluent to either creeks or ditches. Septic systems or connection to a public sewer are of course required for newer construction and have been required since 1967. Although no direct discharges were identified during the Watershed Management Plan water quality monitoring, a sanitary survey was not conducted in the entire creek system of the watershed.

- *Increased Development*

Increased development has the potential to adversely affect the surface water quality and quantity. The increased residential development requiring on-site wastewater disposal systems has a significant potential to affect water quality, due to the limited capacity for septic treatment of the existing soils. Additionally, water quality can be affected by construction practices. Higher density development also contributes to water pollution due to many factors, including increased traffic, increased surface water runoff that may cause erosion and higher peak flows.

Agricultural Practices

A significant portion of the watershed is agricultural, primarily cropland. There is a moderate potential for erosion, due to the nature of the soils within the area, which can impair water quality. Erosion increases the sediment load to surface waters as well as transporting nutrients (phosphorus and nitrogen) from fertilizers. Land use north of the I-80/90 (Indiana Toll Road) is primarily agricultural or undeveloped with some rural-residential development along roadways (see Figure 5).

C. *Identification of Critical Areas*

- *Rhineheart Lateral*

  Water quality sampling results at the Rhineheart Lateral near State Line Road consistently displayed the highest level of *E. Coli* of any of the sampling locations during the four (4) sampling events. The samples at this site also exhibited higher levels of nitrates, phosphorus and TSS than the other five (5) sampling locations. The contributing watershed to the Rhineheart Lateral is located primarily in Michigan.

- *Kindig/Kellog Ditch and Bishop Ditch*

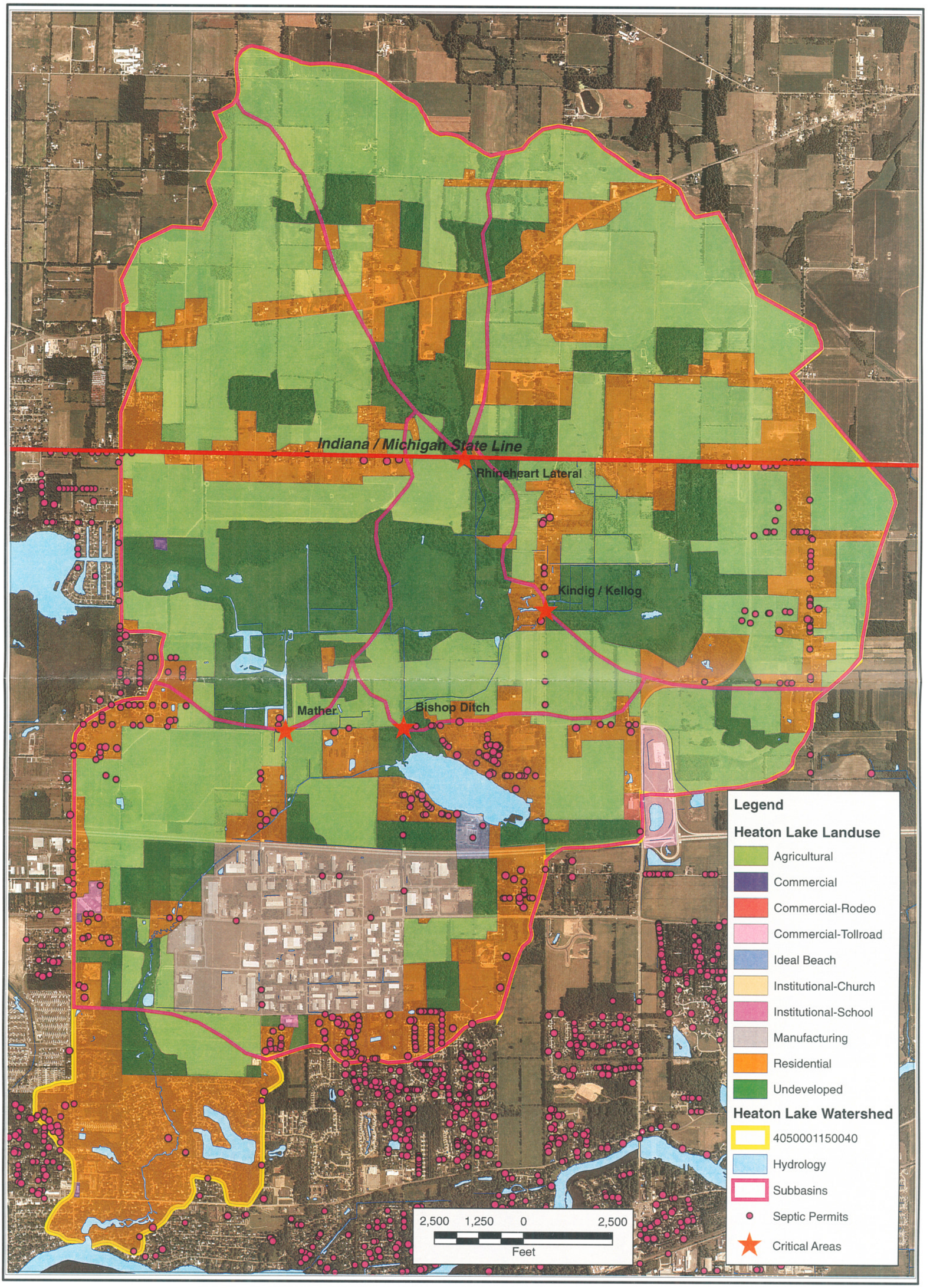
  Low dissolved oxygen levels were noted in both of these ditches during the water quality sampling. Kindig/Kellog Ditch drains directly to Bishop Ditch and the low DO may be an indication of a pollutant source. On a lb. per acre basis, Kindig/Kellog Ditch had the highest and second highest phosphorus and TSS Loadings. The Kindig/Kellog Ditch and Bishop Ditch water samples exceeded State standards for *E. Coli* during wet weather event sampling.

- *Mather Ditch*

  High surfactant levels were noted in Mather Ditch during the water quality sampling on June 10, 2004. A number of residences are located upstream of County Road 4 along Mather Ditch. The high surfactant levels are indicative of domestic waste (soaps and detergents). On the June 10, 2004 wet weather sampling event, the MBAS was measured to be 20 mg/L, a typical concentration found in raw wastewater. However, *E. Coli* level at this site exceeded the water quality standard on only one (1) sampling event at a level of 280 cfu/100 ml.

The sampling points identified as critical areas as well as their contributing watershed boundaries and land uses are shown on Figure 8. These contributing watersheds are primarily the northern half of the study area, and all but the Mather Ditch sub-watershed contribute directly to Heaton Lake. The characteristics of each of these sub-watersheds is primarily agricultural with some rural residential development (with on-site septic systems) along main roadways. Water quality monitoring results indicate the presence of both agricultural and domestic pollutants impacting water quality.

Map Document: (Z:\200406_00\Finals\Figure 8-critical areas.mxd)
1/30/2006 -- 8:35:23 AM



January 2006	200406	Figure 8	LAWSON-FISHER ASSOCIATES P.C. CONSULTING ENGINEERS 525 W. WASHINGTON AVENUE SOUTH BEND, INDIANA 46601 PH. (574) 234-3167	N W E S			Elkhart County 205(j) Grant Puterbaugh Creek - Heaton Lake Watershed Management Plan Critical Areas Map

V. Goals and Action Items

A number of goals have been identified throughout the planning process, based on the concerns and subsequent watershed assessment. Water quality monitoring results, historical water quality and fisheries data, soil types, land use and zoning information were presented at stakeholder meetings along with potential measures to reduce pollutants. Stakeholders were included in the selection and development of the goals and action items for reduction of non-point source pollution. This section itemizes the goals along with proposed action items by which to achieve the goals.

Goal #1: Reduce E. Coli, Nitrates, and Total Suspended Solids (TSS) in Rhineheart Lateral

The Rhineheart Lateral at the Indiana – Michigan State Line exhibited very high levels of *E. Coli* during the sampling events conducted for this Watershed Management Plan. The water quality samples gathered at this site also exhibited higher levels of nitrates and TSS than the other five (5) sampling locations. The existing condition average concentrations are shown below:

Rhineheart Lateral – Existing Condition

Parameter	Wet Weather Average Concentration	Dry Weather Average Concentration	Annual Loading
E. Coli	16,200 col/100 mls	2,050 col/100 mls	1.1xE14 cols
Nitrates	1.44 mg/L	0.57 mg/L	3,300 lb.
TSS	29.5 mg/L	83.5 mg/L	133,000 lb.

Action Items:

- *Identify Specific Source(s) of Contamination*

  The sampling results in Rhineheart Lateral indicate high levels of *E. Coli*, suggesting either contamination from septic systems, wildlife or livestock contamination or runoff from agricultural land use. A system of dye testing any homes in Michigan that are adjacent to Rhineheart Lateral should be conducted to identify the specific source of the contaminants if it is determined that the contamination source is from a septic system. It is conceivable that the source or sources may be some distance from the Rhineheart Lateral sampling site, and is transported through agricultural field tiles. The Elkhart County Health Department would need to coordinate with the Cass County (Michigan) Health Department in order to identify the source(s) of the contamination.

- *Eliminate Source(s) of Contamination*

  Since the Rhineheart Lateral sampling site is located at the Indiana – Michigan state line, the Elkhart County Health Department would need to coordinate with the Cass County (Michigan) Health Department in order to eliminate the source of the contamination. The two (2) respective Health Departments could work with the property owner(s) to rectify the situation. If public sewer is available and the source is determined to be from a failing septic system, the failing system should be connected to a public sewer. In areas with high concentrations of failing systems, other alternatives to providing wastewater treatment should be explored (see Goal #4).

- *Explore Funding Source(s) To Eliminate Septic Waste*

  Typically, property owners fund repair to their septic systems. However, if it is determined that the source of the *E. Coli* contamination in Rhineheart Lateral is due to a failing septic system, the Michigan State Revolving Fund (SRF) may be a potential source of funding to help assist Cass County in the elimination of failing on-site wastewater systems. The SRF does not provide funding to individual homeowners for the correction of their systems, but it does provide funding to municipalities for construction of sewage treatment works.

  The cost to repair or replace a septic system can vary from $2,000-$12,000+ per system depending on site specific conditions.

Indicators of Success:

There are several indicators of progress associated with Goal #1 including:

- Identification of source or sources of contamination.

- Coordination with property owner or owners to develop a plan to remedy failing septic system or systems.

- Completion of septic system repair/replacement or connection to public sewer.

- Reduced *E. Coli*, nitrates, MBAS (surfactants) and TSS concentrations in Rhineheart Lateral. The levels of *E. Coli* during the sampling were extremely high in Rhineheart Lateral and the nitrate and TSS levels were higher than the sampling results at the other five (5) sampling locations that were monitored as part of this Watershed Management Plan. The actual source of the contamination is not clear. The source of the waste may be originating from a number of residences or just one residence or it may be a result of agricultural runoff. Once the source of the contamination is identified, an actual reduction in pollutant loading can be estimated. Target concentrations for Rhineheart Lateral are given below:

Rhineheart Lateral – Target Condition

Parameter	*Wet Weather Average Concentration*	*Dry Weather Average Concentration*	*Target Annual Average Concentration*	*Target Annual Load*
E. Coli	<1,620 col/100 mls (90% Reduction)	<235 col/100 mls (State Standard)	<800 col/100 mls (93% Reduction)	1.03xE13 cols.
TSS	<2 mg/L	<0.5 mg/L	<2 mg/L	5,690 lb.
MBAS	0.1 mg/L	0.1 mg/L	0.1 mg/L	285 lb.

While the near term goals are stated in the above table, the long term goal for E. Coli shall be to reduce the concentrations to levels at or below water quality standards.

The nitrate levels in Rhineheart Lateral are less than the state standard of 10 mg/L, but this area should be monitored as it consistently had the highest level of nitrates of any of the six (6) water quality sampling locations.

Repair/replacement of failing septic systems will have a positive effect on water quality, but the actual reduction in loading is somewhat dependent on the level of septic system failure and on how much pollutant enters the surface water. An annual pollutant loading reduction for TSS, ammonia and phosphorus per system repaired or replaced is as follows:

Domestic TSS Contribution from Septic Tank Effluent: 0.08 lb./cap/day*
Persons per household: 2.5
TSS reduction per system repair = 0.08 lb./cap/day x 2.5 persons x 365 days per year
= 73 lb/year

Ammonia Contribution from Septic Tank Effluent: 0.01 lb./cap/day**
Persons per household: 2.5
NH4-N reduction per system repair = 0.01 lb./cap/day x 2.5 persons x 365 days/year
= 9 lb./year

Phosphorus Contribution from Septic Tank Effluent: 0.006 lb./cap/day***
Persons per household: 2.5
Total P reduction per system repair = 0.006 lb./cap/day x 2.5 persons x 365 days/year
= 5.5 lb./year

* TSS loading based on average contribution of 0.2 lb./cap/day, 60% removal in septic tank.

** Ammonia loading based on average domestic wastewater strength of 15 mg/L, 80 gal/cap/day and no removal in septic tank.

*** Phosphorus loading based on average domestic wastewater strength of 10 mg/L, 80 gal/cap/day and 10% removal in septic tank.

E. Coli reduction is not calculated, as its concentrations vary significantly based on the length of time it can survive out of its host.

Timeframe:

It is anticipated that the identification of the contamination source and subsequent elimination can be completed within two to three years.

Goal #2: Reduce Surfactants and Suspected Septic Contamination in Mather Ditch

Mather Ditch exhibited high levels of surfactants during the water quality sampling portion of this study.

Action Items:

- *Identify Specific Source(s) of Septic Waste*

  The sampling results in Mather Ditch indicate high levels of surfactants, suggesting contamination from septic systems or household floor drains. The contamination may be a result of a failing on-site wastewater system or an illicit discharge. A system of dye testing the homes that are adjacent to Mather Ditch should be conducted to identify the specific source of the contaminants. It is conceivable that the source or sources may be some distance from the Mather Ditch sampling site, and thus is transported through field tiles. The Elkhart County Health Department can conduct these studies as part of their ongoing septic system program.

- *Eliminate Source(s) of Septic Waste*

  Once the specific source(s) is found, the Elkhart County Health Department will work with the property owner to rectify the situation. The failing system should be connected to a public sewer, if available. In areas with high concentrations of failing systems, other alternatives to providing wastewater treatment should be explored.

  The cost to repair or replace a septic system can vary from $2,000-$12,000+ per system depending on site specific conditions.

- *Explore Funding Source(s) to Eliminate Septic Waste*

  Typically, property owners fund repair to their septic systems. However, the Indiana Department of Environmental Management State Revolving Fund Program is initiating a program to provide financial assistance for nonpoint source projects. Failing septic systems is one nonpoint source of pollution that IDEM envisions funding. Funding is available to cities, towns, counties, townships, non-profit organizations, regional water, sewer or waste districts or conservancy districts. Funding is available as a low interest loan (below market rates) for typically a 20-year period. While these funds are not directly available to the individual homeowner, a separate entity could apply for the funds and administer the funds as appropriate.

Indicators of Success:

There are several indicators of progress associates with Goal #2 including:

- Identification of source or sources of contamination.
- Coordination with property owner or owners to develop a plan to remedy a failing septic system or systems or to eliminate an illicit discharge.
- Completion of septic system repair/replacement or connection to public sewer.

- Reduced surfactant levels in Mather Ditch. Due to the presence of surfactants, the source of contamination is of a domestic nature but the actual source (any particular home(s)) is not clear. The source may be originating from a number of residences or one residence. Once the source of the flows is identified, a reduction in surfactant loading may occur. The target concentration of surfactants should be less than 0.1 mg/L during both wet and dry weather. Existing and target MBAS levels are shown below:

Mather Ditch – MBAS (Surfactants)

Parameter	*Wet Weather Average Concentration*	*Dry Weather Average Concentration*	*Annual Loading*
Existing Condition MBAS	10 mg/L	0.15 mg/L	35,500 lb/yr
Target Condition MBAS	0.1 mg/L	0.1 mg/L	680 lb/yr

- Reduced TSS, *E. Coli*, phosphorus and nitrogen concentrations.

Repair/replacement of failing septic systems will have a positive effect on water quality, but the actual reduction in loading is somewhat dependent on the level of septic system failure and on how much pollutant enters the surface water. An annual pollutant loading reduction for TSS, ammonia and phosphorus per system repaired or replaced is as follows:

Domestic TSS Contribution from Septic Tank Effluent: 0.08 lb/cap/day*
Persons per household: 2.5
TSS reduction per system repair = 0.08 lb/cap/day x 2.5 persons x 365 days per year
= 73 lb/year

Ammonia Contribution from Septic Tank Effluent: 0.01 lb/cap/day**
Persons per household: 2.5
NH4-N reduction per system repair = 0.01 lb/cap/day x 2.5 persons x 365 days/year
= 9 lb/year

Phosphorus Contribution from Septic Tank Effluent: 0.006 lb/cap/day***
Persons per household: 2.5
Total P reduction per system repair = 0.006 lb/cap/day x 2.5 persons x 365 days/year
= 5.5 lb/year

* TSS loading based on average contribution of 0.2 lb/cap/day, 60% removal in septic tank.

** Ammonia loading based on average domestic wastewater strength of 15 mg/L, 80 gal/cap/day and no removal in septic tank.

*** Phosphorus loading based on average domestic wastewater strength of 10 mg/L, 80 gal/cap/day and 10% removal in septic tank.

E. Coli reduction is not calculated, as its concentrations vary significantly based on the length of time it can survive out of its host.

Timeframe:

It is anticipated that the identification of the contamination source and subsequent elimination can be completed within one to two years.

Goal #3: Increase Dissolved Oxygen (DO) levels in Kindig/Kellog Ditch and Bishop Ditch

Kindig/Kellog Ditch and Bishop Ditch exhibited low levels of dissolved oxygen during the water quality sampling phase of this Watershed Management Plan. Dissolved oxygen is an indicator of the waterbody's ability to support aquatic life.

Action Items:

- *Identify Specific Source of Contamination*

  The sampling results in Kindig/Kellog Ditch and Bishop Ditch indicated low levels of DO. Kindig/Kellog Ditch drains directly to Bishop Ditch which in turn drains to Heaton Lake. The water in these two (2) ditches at the sampling locations was fairly stagnant which may be a contributor to the low DO concentrations. Organic matter may be decomposing in these areas and thus contributing to the low DO readings. The DO levels can fluctuate under normal conditions but consistently low levels may be an indicator of biodegradable organic materials being introduced to the surface waters by human activities.

- *Eliminate Source of Contamination*

  Once the contamination source has been identified, if it has been determined that organic materials are being introduced to the ditches by human activities, the Elkhart County Health Department will work with the property owner to rectify the situation.

Indicators of Success:

There are several indicators of success associated with Goal #3 including:

- Identification of source or sources of contamination.
- Coordination with property owner or owners to develop a plan to eliminate the contamination contributing to the low DO levels in Kindig/Kellog Ditch and Bishop Ditch.
- Increased DO levels in Kindig/Kellog Ditch and Bishop Ditch.

Timeframe:

It is anticipated that the identification of the contamination source and subsequent elimination can be completed within one to two years.

Goal #4: Explore Methods to Plan, Construct, Operate, Maintain and Finance Public Wastewater Systems

Outside of the municipalities in the area, public wastewater utilities are limited to Conservancy Districts which cover a limited geographic region. Therefore, communities that may have need of an alternative method (to on-site systems) for treating and disposing of their wastewater have limited abilities to provide such alternative methods. At this time, the County Health Department is able to assist the homeowners on a case by case basis. However, there are some areas where a public system (alternative or conventional) may be a more permanent and economically feasible option. Elkhart County has formed a Regional Sewer District. This provides a means for unincorporated communities within the County to plan, construct, operate, maintain and finance public wastewater systems.

The initial evaluation should be in terms of an identified community that is in need of a public wastewater system. This would provide a pilot project for Elkhart County to address other areas in the future.

Action Items:

- *Evaluate Options with Regional Sewer District*

  The increased development within the watershed as well as other areas in Elkhart County is a stress on the water quality of both surface and ground water sources. The Puterbaugh Creek – Heaton Lake Watershed has soil characteristics such that the capacity for on-site disposal systems is limited. In many cases, specialized systems such as mound systems are required. These systems are quite costly to the individual homeowner. With respect to the Puterbaugh Creek – Heaton Lake Watershed, the evaluation would most likely be limited to the opportunities for expansion of existing systems (City of Elkhart, Heaton Lake) due to its close proximity and the design limitations of existing infrastructure. The community around Heaton Lake is currently working with the Regional Sewer District to provide a public wastewater system. Currently the District is exploring funding sources for project construction. The planning and design phases for the Heaton Lake Project are complete.

- *Discuss Options with Adjacent Public Sewer Systems of the City of Elkhart*

  The City of Elkhart sewer service area includes a small portion of the Puterbaugh Creek – Heaton Lake Watershed. Discussions with the City of Elkhart on the potential to expand their service area to minimize nonpoint source pollution due to failing septic systems should be initiated.

- *Explore Funding Sources*

  There are several funding sources available to the County or other public agencies for planning, construction, operation and maintenance of a public sewer system. The types of funding available depend on the type of entity that is operating the system. Grant and loan funds are also available; typically, on a competitive basis. Grant and loan funds include but are not limited to SRF Funding and USDA Rural Community Assistance Program.

Indicators of Success:

The primary indicator of success for this goal is the identification of a preferred method to plan, finance, construct, operate and maintain a public wastewater system.

Timeframe:

The evaluation of options with the Regional Sewer District as well as discussions with adjacent public sewer systems and exploring funding sources should be conducted as the need arises.

Goal #5: Eliminate Direct Discharges of Septic Tank Effluent

The sampling conducted as part of the 205(j) Grant Project indicated that there are both increasing and decreasing levels of pollutant concentration as you travel downstream from one sample location to the next during both wet and dry weather events indicating that there are sources of waste that are highly variable. Factors that influence the concentrations include the intensity of the rain events, and groundwater levels. For example, in times of a seasonally high water table, a marginally operating septic system may be impacting the surface waters. In any case, there are portions of the various creeks within the watershed that appear to contain sources of human and/or animal wastes. The following table summarizes the wet and dry weather average concentrations of various water quality parameters at the Indiana – Michigan State Line (Rhineheart Lateral), the most upstream point in the watershed and at Bristol Street (Puterbaugh Creek), the most downstream sampling point in the watershed.

State Line Road (Rhineheart Lateral, Site 1)
and
Bristol Street (Puterbaugh Creek, Site 6) – Existing Conditions

Parameter	*Wet Weather Average Concentration*	*Dry Weather Average Concentration*
E. Coli State Line Road	16,200 col/100 mls	2,050 col/100 mls
E. Coli Bristol Street	2,250 col/100 mls	350 col/100 mls
TSS State Line Road	30 mg/L	84 mg/L
TSS Bristol Street	2 mg/L	8 mg/L
Nitrates State Line Road	1.44 mg/L	0.57 mg/L
Nitrates Bristol Street	0.15 mg/L	0.18 mg/L

Action Items:

- *Continue to Monitor E. Coli Levels in Puterbaugh Creek and its Tributaries for Source(s) of Contamination*

  E. Coli measured during the Elkhart County 205(j) Grant Project sampling exceeded the standard of 235 col/100 mls maximum daily concentration in all but one sample during wet weather events. The Elkhart County Health Department should monitor these areas, if possible, and continue to sample for *E. Coli* in Heaton Lake.

  The estimated cost of a monitoring event is $400 per monitoring site.

- *Conduct a Sanitary Survey of Puterbaugh Creek and its Tributaries*

  A sanitary survey should be completed to generate a comprehensive inventory of outfalls discharging to Puterbaugh Creek and its tributaries. The survey areas should be prioritized such that the tributaries identified as critical areas (Mather Ditch, Rhineheart Lateral, Kindig/Kellog Ditch and Bishop Ditch) are surveyed first.

  This activity should be coordinated with the Elkhart County Health Department, the Elkhart County Surveyor's Office, and the City of Elkhart. Additionally, surveys along the Rhineheart Lateral would need to be conducted in cooperation with the Cass County (Michigan) Health Department. This action is also required within the MS4 Urban Areas as part of the NPDES Phase II Stormwater Rules, and IDEM Rule 13.

- *Dye Testing to Identify Source(s) of Septic Tank Effluent*

  Once specific areas of potential septic contamination are identified, a program of dye testing should be conducted to identify which homes or businesses may be contributing to the contamination.

- *Eliminate Source(s) of Septic Waste*

  Once the specific source(s) is found, the Elkhart County Health Department will work with the property owner(s) to rectify the situation. The failing system should be connected to a public sewer, if available. In areas with high concentrations of failing systems, other alternatives to providing wastewater treatment should be explored (see also Goal #4).

- *Explore Funding Source(s) to Eliminate Septic Waste*

  Typically, property owners fund repair to their septic systems. However, the Indiana Department of Environmental Management State Revolving Fund Program is initiating a program to provide financial assistance for nonpoint source projects. Failing septic systems is one nonpoint source of pollution that IDEM envisions funding. Funding is available to cities, towns, counties, townships, non-profit organizations, regional water, sewer or waste districts or conservancy districts. Funding is available as a low interest loan (below market rates) for typically a 20-year period. While these funds are not directly available to the individual homeowner, a separate entity could apply for the funds and administer the funds as appropriate.

Indicators of Success:

There are several indicators of progress associated with Goal #5 including:

- Collection of additional water quality data.
- Identification of source or sources of contamination.
- Coordination with property owner or owners to develop a plan to remedy failing septic system or systems.
- Completion of septic system repair/replacement or connection to public sewer.
- Reduced *E. Coli,* nitrogen, TSS, phosphorus, and MBAS (surfactants) concentrations in Puterbaugh Creek and its tributaries.

  The specific source(s) of *E. Coli*, TSS, nutrients and MBAS are not known at this time, so the exact total target reduction due to Goal #5 alone cannot be determined. However, reasonable reduction targets associated with all action items for the watershed are listed in the following table:

Puterbaugh Creek and Tributaries Target Conditions

Parameter	*Wet Weather Average Concentration*	*Dry Weather Average Concentration*	*Annual Average Concentration**	*Target Annual Loading**
E. Coli	Reduce 30%	Reduce 20%	975 col/100 mls (25% Reduction)	1.4xE14 col/yr
MBAS	<0.1 mg/L	<0.1 mg/L	0.1 mg/L	3,250 lb/yr
TSS	Reduce 30%	Reduce 20%	4 mg/L (25% reduction)	134,000 lb/yr
Nitrates	Reduce 30%	Reduce 20%	0.13 mg/L (25% reduction)	4,080 lb/yr

* Based on Sample Site 6.

While the near term goals are stated in the above table, the long term goal for E.Coli shall be to reduce the concentrations to levels at or below water quality standards.

Repair/replacement of failing septic systems will have a positive effect on water quality, but the actual reduction in loading is somewhat dependent on the level of septic system failure and on how much pollutant enters the surface water. An annual pollutant loading reduction for TSS, ammonia and phosphorus per system repaired or replaced is as follows:

Domestic TSS Contribution from Septic Tank Effluent: 0.08 lb/cap/day*
Persons per household: 2.5
TSS reduction per system repair = 0.08 lb/cap/day x 2.5 persons x 365 days per year
= 73 lb/year

Ammonia Contribution from Septic Tank Effluent: 0.01 lb/cap/day**
Persons per household: 2.5
NH4-N reduction per system repair = 0.01 lb/cap/day x 2.5 persons x 365 days/year
= 9 lb/year

Phosphorus Contribution from Septic Tank Effluent: 0.006 lb/cap/day***
Persons per household: 2.5
Total P reduction per system repair = 0.006 lb/cap/day x 2.5 persons x 365 days/year
= 5.5 lb/year

* TSS loading based on average contribution of 0.2 lb/cap/day, 60% removal in septic tank.

** Ammonia loading based on average domestic wastewater strength of 15 mg/L, 80 gal/cap/day and no removal in septic tank.

*** Phosphorus loading based on average domestic wastewater strength of 10 mg/L, 80 gal/cap/day and 10% removal in septic tank.

E. Coli reduction is not calculated, as its concentrations vary significantly based on the length of time it can survive out of its host.

Timeframe:

The collection of additional water quality data should be an on-going activity to monitor the watershed for new concerns and identify specific sources as well as to verify the results of the efforts to eliminate pollutant sources. However, once an area of concern is identified, the area should be investigated within one year to identify the specific source. Once source(s) of contamination are identified, it is anticipated that it may take 1 to 2-years to remove the contamination.

Exploring funding sources should be initiated within one year. However, this activity should be on-going as the amount and types of funding available vary from year to year as well as the requirements to qualify for such funding.

Completion of the sanitary survey for Puterbaugh and its tributaries should take place within 5-years.

Goal #6: Discourage Medium to High Density Development Requiring On-Site Wastewater Systems where the Soils are not Adequate to Treat the Septic Effluent in Order to Protect Surface Waters and Groundwater

Currently, new subdivisions and developments are reviewed by the Planning Commission for approval. The developments must meet the requirements of the current subdivision and planning ordinances. Any new on-site systems also must be permitted by the Elkhart County Health Department and meet State Standards.

Action Items:

- Review existing ordinances and policies, and revise as-needed, with respect to existing subdivision and zoning regulations.
- Review Watershed Management Plan with Planning Commission to demonstrate issues with on-site wastewater treatment systems in limiting soils.
- Participate with Planning Commission on zoning issues.

Indicators of Success:

- Monitor number, location and type of septic system permits. Compare permit locations with zoning and land use plans.

- With respect to water quality in Puterbaugh Creek and its tributaries, the target for this goal is to see no increase in *E. Coli*, NH_3-N or TDS due to new development.

Timeframe:

The timeframe for this goal is to review the existing ordinances and policies and revise as needed within 1-year. Attention to planned development with respect to appropriate uses and protecting water quality should be an on-going activity.

Goal #7: Use the Puterbaugh Creek – Heaton Lake Watershed Management Plan as a Template to Address E. Coli in Other Elkhart County Watersheds

As identified during the Elkhart County Commissioner's 319 Grant Project for the Yellow Creek (lower) Watershed Management Plan, there are several watersheds within Elkhart County that currently experience high *E. Coli* levels due to either development or agricultural practices.

Action Items:

- Continued Sampling by the Elkhart County Health Department to identify areas of water quality impairment.

- Develop a Watershed Management Plan(s) for other areas. The estimated cost of developing a Watershed Management Plan of similar scope and detail as this plan is $60,000-$80,000.

- Develop a program of sanitary surveys for the entire County.

- Explore methods for funding Watershed Management Plans and Water Quality Improvement Projects. Grant funding sources include IDEM 205(j) Grants and IDEM 319 Grants.

Indicators of Success:

Indicators of success for this goal include the development and implementation of Watershed Management Plans for other impaired watersheds.

Timeframe:

The water quality investigations conducted by the Elkhart County Health Department are an on-going activity to monitor watersheds and identify areas of concern. The initiation of a Watershed Planning Project in another Elkhart County Watershed should occur within 5-years.

Goal #8: Continue to Educate Residents of On-Site Wastewater Systems

Action Items:

- Distribute education information at appropriate locations and events. Educational information can be distributed at public locations such as County Buildings, Public Libraries and at Public Meetings addressing water quality. The Elkhart County Fair is also a good location for distribution of these educational materials.
- Continue to educate public through the investigation of failing septic systems.
- Collect educational materials from various sources (i.e. IDEM, USEPA, and National Small Flows Clearinghouse) for use and distribution within the watershed.
- Develop a web-page. The estimated cost for this activity is $1,000.

Indicators of Success:

- Web page development.
- Tally events and locations educational information is distributed.
- While providing educational and information opportunities regarding on-site systems does not have a direct effect on water quality in the short term, the long term goal is to increase awareness and better on-site system operation and maintenance resulting in decreased nutrients, *E. Coli* and TDS to the surface waters.

Timeframe:

Goal #8 is an on-going process to increase awareness and promote good management practices for residences and commercial establishments with on-site disposal systems. This goal should be initiated within 1-year.

Goal #9: Continue an Education Program on Water Quality and Management Practices to Reduce Contaminants to Surface Waters

Action Items:

- Encourage a science program within the local school systems to address water quality and watershed issues. The information provided in the Watershed Management Plan could be incorporated as well as a site visit to give a local tie to water quality. The Elkhart County Soil and Water Conservation District can provide educational training, materials and assistance to interested educators for a project, specifically through current programs such as "project wet" and "project wild". The program should be structured such that the state science standards are met. Providing educational opportunities in the classroom not only informs a future generation, but also provides another avenue for information to be supplied to their parents.

- Recruit an individual or group (this could be a school classroom) to participate in the Hoosier River Watch Program to collect water samples for Puterbaugh Creek and its tributaries or Heaton Lake. The SWCD would also be involved in the training for water quality sampling in this program.

- Web-page. The estimated cost for this activity is $1,000. This activity can be linked with Goal #8.

- The SWCD/NRCS incorporates their newsletter on a monthly basis into the local (Elkhart County) editions of the Farmer's Exchange Newspaper. An article(s) could be published on the Puterbaugh Creek – Heaton Lake Watershed Management Plan, as well as updates on the implementation of the plan.

- Newspaper articles on local water quality issues.

- Collect educational materials from various sources (i.e. IDEM, USEPA, IDNR, USDA, National Small Flows Clearinghouse) for use and distribution within the watershed.

- All forms of media (newspaper, radio, television and internet) are an avenue for continuing education.

Indicators of Success:

- Web page development.

- Tally events and locations educational information is distributed.

- Number of classrooms adopting watershed program as part of their science curriculum.

- Hoosier River Watch participation within the watershed.

- While providing educational and information opportunities regarding sound watershed practices does not have a direct effect on water quality in the short term, the long term goal is to have a positive effect on watershed management practices resulting in decreased nutrients, *E. Coli* and TDS to the surface waters.

Timeframe:

Goal #9 is an on-going process to increase awareness and promote a pro-active approach to watershed management by the citizens of the Puterbaugh Creek – Heaton Lake Watershed. The school science program, the collection of water quality samples, and the inclusion of water quality issues onto the web-page can occur within a 3-year period. The remaining action items can be considered on-going items.

Goal #10: Develop and Implement BMPs to Reduce Sources of Contaminants

Action Items:

- Agricultural BMPs:

  A number of BMPs are appropriate to reduce sediment and pollutant load to surface waters. The two main BMPs to consider are Filter Strips and Crop Management Practices.

  With respect to crop management, the following table provides existing (2002) conditions in Elkhart County, according to NRCS:

Existing Condition – Cropland Tillage Data

Tillage Practice	*2002 Cropland Tillage Data - Corn*	*2002 Cropland Tillage Data - Soybeans*
No Till – Any direct seeding system, including strip preparation, with minimal soil disturbance.	18%	39%
Mulch Till – Any tillage system leaving greater than 30% crop residue cover after planting, excluding no-till	10%	39%
Conventional – Any tillage system leaving less than 30% crop residue cover after planting.	71%	21%
Nonapplicable – Hay, CRP, fallow or other non-annually seeded crops.	1%	1%

Reference: www.in.nrcs.usda.gov

Increased conservation tillage is dependent on cooperation with the agricultural producers in the area and directly linked to the educational and informational efforts in Goal #9. Increases in conservation tillage practices are also a function of the funding sources available. However, a reasonable target for increased conservation tillage is a 5% increase over 5-years.

With respect to filter strips, approximately 100 acres on average are constructed in Elkhart County per year. A reasonable target for the Puterbaugh Creek – Heaton Lake Watershed is construction of 5 acres over 5-years.

Filter strip construction can range from $13,000-$30,000 per acre (depending if seed or sod is used). This cost does not include the land cost.

- Review County Subdivision and Roadway Standards, incorporate (if necessary) Best Management Practices (BMPs) to address erosion control for both construction and post construction cases.

BMPs to consider include silt fences, straw bales, catch basins, grassed swales, detention ponds and vegetative filter strips.

This action item is integral with the NPDES Stormwater Phase II Regulations (IDEM Rule 13) that affects a significant portion of the watershed.

- Explore funding sources for BMPs.

A number of funding sources are available to assist in implementation of BMPs. Several sources are described below:

LARE Funds (Lake and River Enhancement Program) – These funds are available for water quality project implementation when a diagnostic study has been completed for the watershed. The existing water quality sampling results can be augmented to meet the diagnostic study requirements, so that implementation funds can be applied for.

EQIP Funds (Environmental Quality Incentive Program) – These funds are cost sharing programs available to agricultural producers and can be used for filter strips and other agricultural BMPs. These funds are administered by the NRCS, and the amount of funds vary from year to year.

CRP Funds (Conservation Reserve Program) – These funds are cost sharing funds available to agricultural producers and can be used for Crop Management Practices.

IDEM 319 Grants – These funds are grant funds available for water quality improvement projects. There is a requirement for 25% cost sharing of cash or in-kind services with this grant program.

Indicators of Success:

- Tally BMPs implemented within watershed by type and date.

- Agricultural BMPs:

  Increased conservation tillage and filter strips will result in decreased nutrient and solids loading to Puterbaugh Creek and its tributaries. The sediment, nutrient and phosphorus loading reductions can be estimated for the agricultural BMPs, once specific projects are identified. The reductions are typically based on contributing area, soil type and land use. The *Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual*, (MDEQ, June 1999) can be used to estimate pollutant loading reductions for each BMP implemented.

  The Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual and pollutant load reduction estimate program was utilized to estimate reductions in soil loss, nitrogen and phosphorus due to the construction of filter strips and increasing conservation tillage practices in he watershed.

Assuming 5 acres of filter strips were constructed in an area of Gilford Soils (prime farmland) which are loamy sandy soils, the following load reductions are estimated:

Estimated Sediment Load Reduction	=	7 ton/year
Estimated Phosphorus Load Reduction	=	10 lb/year
Estimated Nitrogen Load Reduction	=	18 lb/year

Using the target of increasing the conservation tillage by 5% in 5 years in the watershed, the load reduction in nutrients can also be estimated. The following assumptions were used to estimate the sediment, phosphorus and nitrogen load reductions:

- 124 Acres (5% of agricultural land-use)
- Soybeans
- Gilford soils (prime farmland)
- No-Till, 30% cover practice vs. conventional, fall plow

Based on the above assumptions, the following load reductions a due to increased conservation tillage practices are estimated:

Estimated Sediment Load Reduction	=	125 tons/year
Estimated Phosphorus Load Reduction	=	133 lb/year
Estimated Nitrogen Load Reduction	=	266 lb/year

Soil reduction estimate worksheets are included in Appendix E. The actual reduction will be dependent on where the BMPs are applied.

The reduction in pollutants from other BMPs (i.e. manure management and exclusion fencing) are site specific; and, therefore, cannot be reasonably estimated until specific agricultural land areas are identified for increased conservation practices.

- Residential and Commercial BMPs:

  The residential and commercial BMPs suggested are tied most specifically to new construction and future development. As such, they will not have a major impact on existing pollutant loads. However, inclusion of the BMPs in the development standards will minimize impacts of future development on water quality primarily with respect to nutrients, solids and quantity of flows.

- Estimate load reduction based on specific BMPs as they are implemented.

Timeframe:

Encouraging the implementation of BMPs should be an ongoing effort. With respect to specific BMPs, the following timeframes and targets are suggested:

- Conservation Tillage – Increase 5% in 5-years.

- Filterstrips – Construct 5 acres in 5-years.

Goal #11: Identify a Watershed Coordinator

Action Items:

- A number of water quality and wet weather issues exist within Elkhart County, including those outlined in the Puterbaugh Creek – Heaton Lake Watershed Management Plan and NPDES Stormwater Phase II. It may be appropriate to identify a watershed coordinator within the County or SWCD to oversee the implementation of this Management Plan as well as other water quality issues. The coordinator would provide water quality continuity throughout the County. In absence of a Watershed Coordinator, the Elkhart County Administrator will oversee the implementation of this Plan. It should be noted that Elkhart County currently has a position for an Urban Conservationist in the Soil and Water Conservation District Office. This position's primary responsibility would be the implementation of the requirements of IDEM's Rule 13 which addresses the new NPDES Stormwater Phase II regulations.

- Explore Funding Sources for a Watershed Coordinator. A logical funding source could be General County Revenues in conjunction with the SWCD.

Indicators of Success:

The indicator of success for this goal is to have a watershed coordinator for this Plan as well as other potential plans within the County.

Timeframe:

A watershed coordinator should be identified within 1 year.

Goal #12: Continue to Work Cooperatively with Other Watershed Groups within the St. Joseph River Basin

Action Items:

- Attend Joint Steering Committee Meetings.

- Present status updates on the implementation of the Watershed Management Plan at the Committee Meetings.

Indicators of Success:

The indicator of success is a log of meetings and watershed groups.

VI. Implementation Plan

A. Plan and Schedule

Each of the goals and action items detailed in the previous section are summarized in Table 12, along with the entities responsible for carrying out the action items and a proposed timeframe for each action. The timeframe includes a schedule that places a higher priority on critical areas.

B. Calendar of Events and Project Milestones

A list of Watershed Management Plan Events, past and future, and target project milestones is provided in Table 13.

Table 12
Puterbaugh Creek – Heaton Lake Watershed Management Plan
Goals and Action Items

GOALS	*ACTION ITEMS*	*RESPONSIBLITY*	*TIMEFRAME*
Goal #1: Reduce E. coli, Nitrates, and Total Suspended Solids (TSS) in Rhineheart Lateral	Identify the specific source(s) of waste: Conduct a systematic dye testing program of adjacent homes and farm field tiles	ECHD, Cass County Health Department (CCHD)	1-Year
	Eliminate source(s) of waste: Once the contamination source(s) are identified, the ECHD and the Cass County Health Department will need to work together to rectify the situation.	ECHD, CCHD, Property Owner	1-2 Years
Goal #2: Reduce Surfactants and Suspected Septic Contamination in Mather Ditch	Identify specific source(s) of waste: Conduct a systematic dye testing program of adjacent homes.	ECHD	1-Year
	Eliminate source(s) of waste: Once the failing system(s) are identified, the ECHD will work with the property owner to rectify the situation.	ECHD, Property Owner	1-2 Years
Goal #3: Increase Dissolved Oxygen (DO) levels in Kindig/Kellog Ditch and Bishop Ditch	Identify the specific source(s) of waste: Determine if organic matter is decomposing in these areas and contributing to the low DO readings	ECHD	1-Year
	Eliminate source(s) of waste: Once the contamination source(s) are identified, the ECHD will work with the property owner to rectify the situation.	ECHD, Property Owner	1-2 Years
Goal #4: Explore methods to plan, construct, operate, maintain, and finance public wastewater systems	Evaluate options with Regional Sewer District. Coordinate with existing public sewer systems (City of Elkhart).	ECC	2-Years
Goal #5: Eliminate direct discharges of septic tank effluent	Continue to monitor E. Coli levels in Puterbaugh Creek and its tributaries and Heaton Lake.	ECHD	Ongoing
	Conduct a sanitary survey of Puterbaugh Creek and its tributaries; perform dye testing once specific areas of septic contamination are identified.	ECHD	5-Years
	Eliminate source(s) of septic waste: Once the contamination source(s) is identified, the ECHD will work with the property owner to rectify the situation.	ECHD	1-2 Years
	Explore funding source(s) to eliminate septic waste	ECHD	Ongoing
Goal #6: Discourage medium to high density development requiring on-site wastewater systems where the soils are not adequate to treat the septic effluent in order to protect the surface waters and groundwater	Review existing ordinances, policies, and land use plans and revise as needed, with respect to existing subdivision and zoning regulations.	Elkhart County EC Planning Dept.	1-Year
	Encourage development to occur in areas where public sewer systems are available.	EC Planning Dept.	Ongoing
Goal #7: Use the Puterbaugh Creek – Heaton Lake Watershed Management Plan as a template to address E. Coli in other Elkhart County watersheds	Continued sampling by ECHD to identify areas of water quality impairment.	ECHD	Ongoing
	Develop watershed management plan(s) for other areas.	ECC/SWCD	5-Years
	Develop a program of sanitary surveys for the entire county. This item may be coordinated with IDEM Rule 13.	ECHD	3-Years
Goal #8: Continue to educate residents of on-site wastewater systems	Distribute educational information at appropriate locations and events.	ECHD, ECC, SWCD	Ongoing
	Continue to educate public through the investigation of failing septic systems.	ECHD	Ongoing
	Develop a web-page addressing non-point source pollution and wet weather issues.	ECHD/SWCD	Ongoing
	Educate public through local media (newspaper, television, and radio).	ECHD/SWCD	Ongoing
Goal #9: Continue an education program on water quality and management practices to reduce contaminants to surface waters	Encourage a science program through the local school systems to address local water quality and watershed issues.	SWCD	3-Years
	Recruit an individual or group (school classroom) to participate in the Hoosier River Watch Program collecting water samples from Puterbaugh Creek, its tributaries, or Heaton Lake.	SWCD, Public	3-Years
	Include water quality issues on web-page.	ECHD/SWCD	3-Years
	Publish articles in the SWCD/NRCS newsletter that is incorporated monthly into local issues of the Farmer's Exchange Newspaper.	SWCD/NRCS EC Extension	Ongoing
	Educate public through the local media (newspaper, television, and radio).	ECHD/SWCD	Ongoing
Goal #10: Develop and implement BMP's to reduce sources of contaminants	BMPs to address agricultural sources of pollution include filter strips, crop management plans, and manure management plans.	ECHD, SWCD, NRCS	Ongoing
	Review County Subdivision and Roadway Standards. Incorporate (if necessary) BMPs to address erosion control for both construction and post construction conditions.	EC Planning Dept. EC Highway Dept.	2-Years
	Include BMPs on web-page.	ECHD/SWCD	3-Years
	Encourage conservation practices to address erosion associated with crops. There are cost sharing programs to assist agricultural producers.	NRCS/SWCD	Ongoing
Goal #11: Identify a watershed coordinator	Identify coordinator.	ECC/SWCD	1 – Year
Goal #12: Continue to work cooperatively with other watershed groups within the St. Joseph River basin	Attend Joint Steering Committee Meetings.	ECC/ECHD, SWCD	Ongoing

Table 13
Calendar of Events and Project Milestones

Event or Project Milestone	Date/Timeframe	Activity
Milestone	January 1, 2004	ECC 205(j) Grant Project Begins
Event	March 11, 2004	Puterbaugh Creek – Heaton Lake Watershed, 1st Public Meeting
Event	June 7-8, 2004	INDOT Stream Restoration Training Workshop
Event	June 16, 2004	Joint Steering Committee Meeting (Public Meeting)
Event	September 15, 2004	Getting in Step: Engaging and Involving Stakeholders in Your Watershed Seminar
Event	September 29, 2004	Joint Steering Committee Meeting (Public Meeting)
Event	December 15, 2004	Joint Steering Committee Meeting (Public Meeting)
Event	March 24, 2005	Joint Steering Committee Meeting (Public Meeting)
Event	June 23-24, 2005	Urban Watershed Management BMPs Seminar
Event	June 30, 2005	Joint Steering Committee Meeting (Public Meeting)
Event	October 6, 2005	Joint Steering Committee Meeting (Public Meeting)
Event	November 16, 2005	Joint Steering Committee Meeting (Public Meeting)
Event	January 1, 2006	ECC 205(j) Grant Project Ends
Milestone	January, 2006 – January, 2007	Identify Watershed Coordinator. (Goal 11)
Milestone	January, 2006 – January, 2007	Identify Source(s) of Rhineheart Lateral Contamination. (Goal 1)
Milestone	January, 2006 – January, 2007	Identify Source(s) of Mather Ditch Contamination. (Goal 2)
Milestone	January, 2006 – January, 2007	Identify Source(s) of Kindig/Kellog Ditch and Bishop Ditch Contamination. (Goal 3)
Milestone	January, 2006 – January, 2007	Review existing ordinances, policies and land use plans. (Goal 6)
Milestone	January, 2006 – January, 2008	Evaluate means to plan, finance, construct, operate and maintain public wastewater systems. (Goal 4)
Milestone	January, 2006 – January, 2008	Review County Subdivision and Roadway Standards. Incorporate (if necessary) appropriate BMPs for construction and post construction conditions. (Goal 10)
Milestone	January, 2006 – January, 2009	Encourage science program through local school system. (Goal 9)
Milestone	January, 2006 – January, 2009	Recruit an individual or group to participate in Hoosier River Watch Program. (Goal 9)
Milestone	January, 2007 – January, 2009	Eliminate source(s) of Rhineheart Lateral Contamination. (Goal 1)
Milestone	January, 2007 – January, 2009	Eliminate source(s) of Mather Ditch Contamination. (Goal 2)
Milestone	January, 2007 – January, 2009	Eliminate source(s) of Kindig/Kellog Ditch and Bishop Ditch Contamination. (Goal 3)
Milestone	January, 2006 – January, 2011	Perform sanitary survey of Puterbaugh Creek and its tributaries. (Goal 5)
Milestone	January, 2006 – January, 2011	Use the Puterbaugh Creek – Heaton Lake Watershed Management Plan as a template for other watersheds. (Goal 7)
Milestone	January, 2006 – January, 2011	Increase conservation tillage practices by 5% within the watershed. (Goal 10)
Milestone	January, 2006 – January, 2011	Construct 5 acres of filter strips within the watershed. (Goal 10)

VII. Evaluating and Adapting the Plan

The Watershed Management Plan will be evaluated by assessing the progress made on each Goal identified in the previous sections. The evaluation of the Plan will be the responsibility of Elkhart County and should be conducted by the Watershed Coordinator. In the interim, prior to identification of a Watershed Coordinator, evaluating and adapting the Plan will be the responsibility of the Elkhart County Administrator.

The plan should be evaluated every two years to assess the progress made as well as to revise the plan if appropriate based on the progress achieved as well as additional information gathered. The Plan is meant to be a flexible tool to achieve water quality improvements within the Puterbaugh Creek – Heaton Lake Watershed.

References:

1. Hydrogeologic Atlas of Aquifers in Indiana,
   USGS Water Resources Investigations Report 92-4142, 1994

2. Elkhart County, Indiana Handbook and Relocation Guide, 2002

3. History of Elkhart County, Indiana, 1881

4. Soil Survey of Elkhart County, USDA and NRCS, 2002

5. Soil Survey of Cass County, USDA & NRCS, 1991

6. Classification of Wetlands and Deepwater Habitats of the United States, United States Department of the Interior, Fish and Wildlife Service, 1979